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SEEING AMERICA FROM THE "SHENANDOAH"

An Account of the Record-making 9,000-mile Flight from the Atlantic to the Pacific Coast and Return in the Navy's American-built, American-manned Airship

BY JUNIUS B. WOOD

AUTHOR OF "THE FAR EASTERN REPUBLIC," "YAP AND OTHER PACIFIC ISLANDS UNDER JAPANESE MANDATE," AND "A VISIT TO THREE ARAB KINGDOMS," IN THE NATIONAL GEOGRAPHIC MAGAZINE

ON THE morning of October 7 last the big Navy airship, U. S. S. *Shenandoah,* was starting from Lakehurst, New Jersey, on its record-making cruise of more than 9,000 miles, twice over the Rockies and twice around three sides of the United States.

The autumn sun was peeping over the horizon at 5:35 a. m., as the *Shenandoah* was led out of the big hangar. Every man on the station helped, 300 of them—sailors, marines, Filipino mess boys, and civilians. They came running into the drear, misty morn like little ants pulling an immense gray worm out of its nest. The run slackened to a walk when she was safely clear of the shed.

Nose to the wind, she was led farther into the field toward the mast, the crew stumbling and slipping in the loose sand. They stopped and waited.

MOORED TO THE MAST, READY FOR THE START

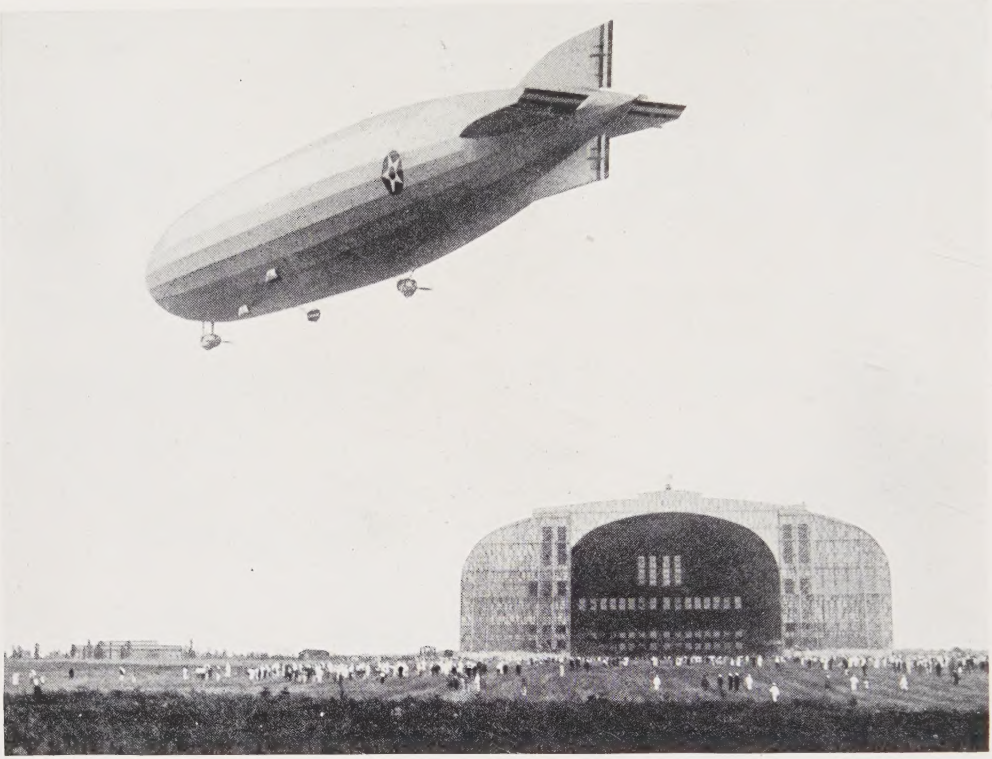
The sun's rays were warming the cells in the big tube and the gas was expanding like a morning-glory. The ship tugged to rise higher. The men braced themselves, held and led her closer to the mast.

A long cable dropped from the ship and was hooked to its mate, trailing on the ground from the mooring mast. A winch rumbled and the big, docile craft was pulled down until the swivel pear on its nose nestled into the cup on the tower. It was moored. That was at 7 a. m., and all hands stopped for breakfast.

At 10 o'clock the ship was ready to cast off. During the three hours, the sun had been warming the helium gas as if it were in a hothouse. With each degree that its temperature rose above that of the surrounding air, the ship was lifting another 300 pounds. More fuel, more supplies, and more officers and men had gone aboard, one by one and each to a particular spot in the long keel tunnel.

While the ship's nose rests on the mast, the delicate balance must be maintained. With a mast only 160 feet high and a big tube 682 feet long, not many degrees' drop is possible before the tail fins scrape the ground.

The earth was beginning to radiate the heat of the sun. The start must be made while the ship held its handicap of superheat. The little elevator in the mast had brought up its last passenger. The fuel was being piped on in driblets, valves



Photograph by Pacific and Atlantic

THE "SHENANDOAH" LEAVES LAKEHURST FOR A TEST FLIGHT

The initial flight of the Navy's great aircraft was made on September 4, 1923, covering 40 miles in about one hour. Ease in handling the ship at low speeds—an important feature of rigid airship performance—was demonstrated. This was the first time in the history of aviation that a rigid airship was flown when inflated with the noninflammable helium gas.

opening and shutting, holding her down with a few more pounds every time she strained to go higher.

Lieutenant Commander Zachary Lansdowne, the captain, had gone aboard. Usually he was next to the last to leave the mast. After him came the mooring officer, who closed the gangway after him, making it part of the ship's well-rounded nose. This time the ship's sole civilian passenger was later than the captain.

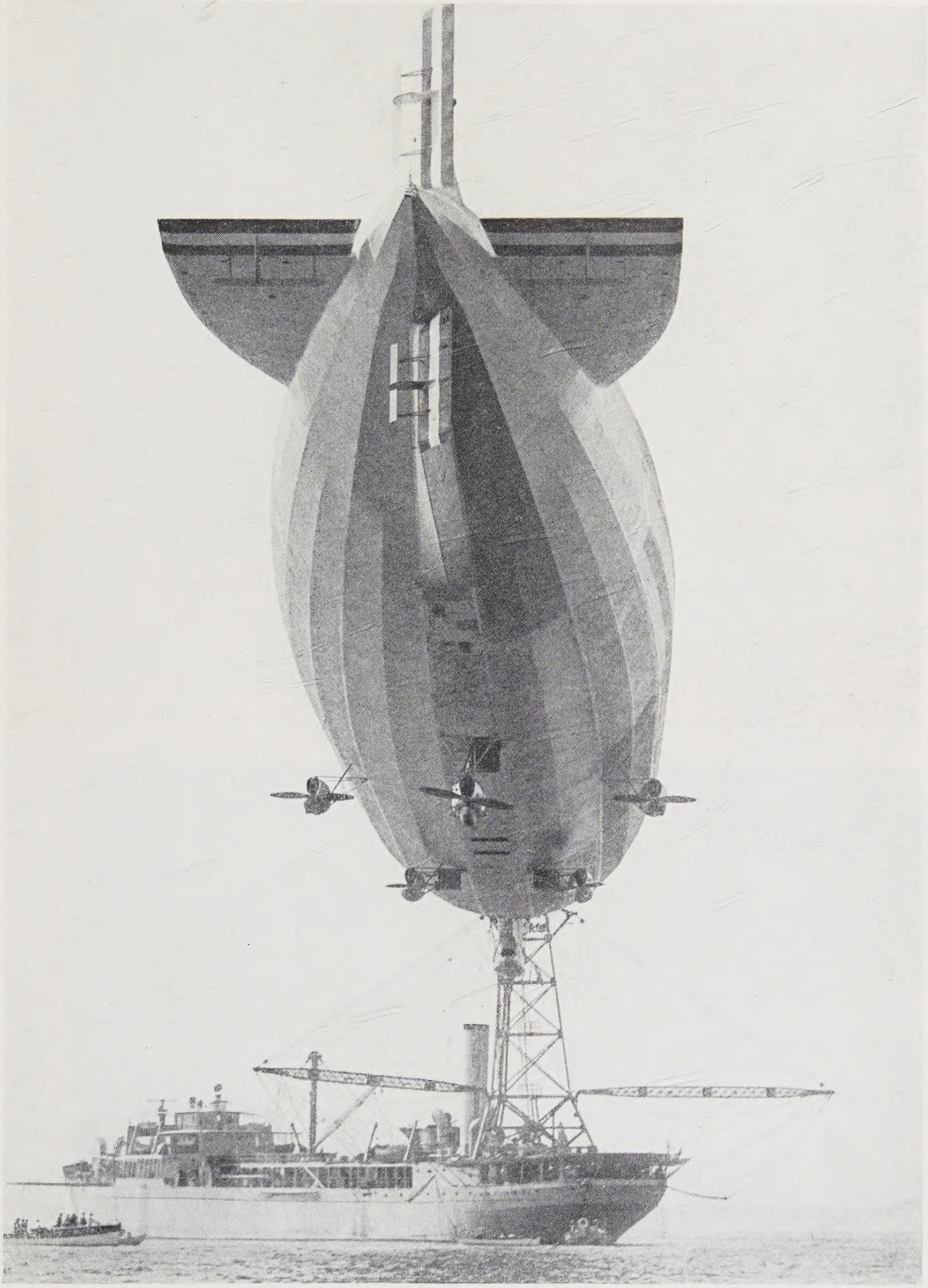
"Ahoy, control car! Mr. Wood is waiting to come aboard, sir," a chief petty officer on the mast shouted through a megaphone.

"Tell Mr. Wood to stand by," the officer of the deck had megaphoned back.

Each one, as he came to the top of the mast, had asked permission from the "bridge" before he had stepped on to the little gangway. At times the ship was buoyant enough to take him. Others had been ordered to "stand by." In a few minutes the ship would grow lighter, and the order would come for one more to step aboard. That meant only minutes for them, for it was certain that they were going. It meant more for the passenger. Weight in fuel took precedence over passenger cargo. If enough "lift" remained after the required amount of gasoline was aboard, the passenger was going; otherwise, no passenger.

AN ANXIOUS MOMENT

To be all ready for a cruise into the great unknown, to get within one step of it, and then, perhaps, to get no farther, provides an anxious moment. Though the possibility had been anticipated, it was no less critical when it arrived. Personal baggage was limited to six pounds. A pair of socks, a suit of underwear, two handkerchiefs, a towel and cake of soap,



Official Photograph, U. S. Navy

AT THE MOORING MAST OF THE U. S. S. "PATOKA"

On August 8, 1924, the *Shenandoah* was made fast to the mooring mast in the stern of the airship tender *Patoka,* in Narragansett Bay, and thereby became the first airship in the world to moor to a floating ship. An additional test was made when the tender steamed 3 miles to a station off Middletown Beach, while the *Shenandoah* trailed astern without any perceptible swaying or plunging.

Photograph from Junius B. Wood

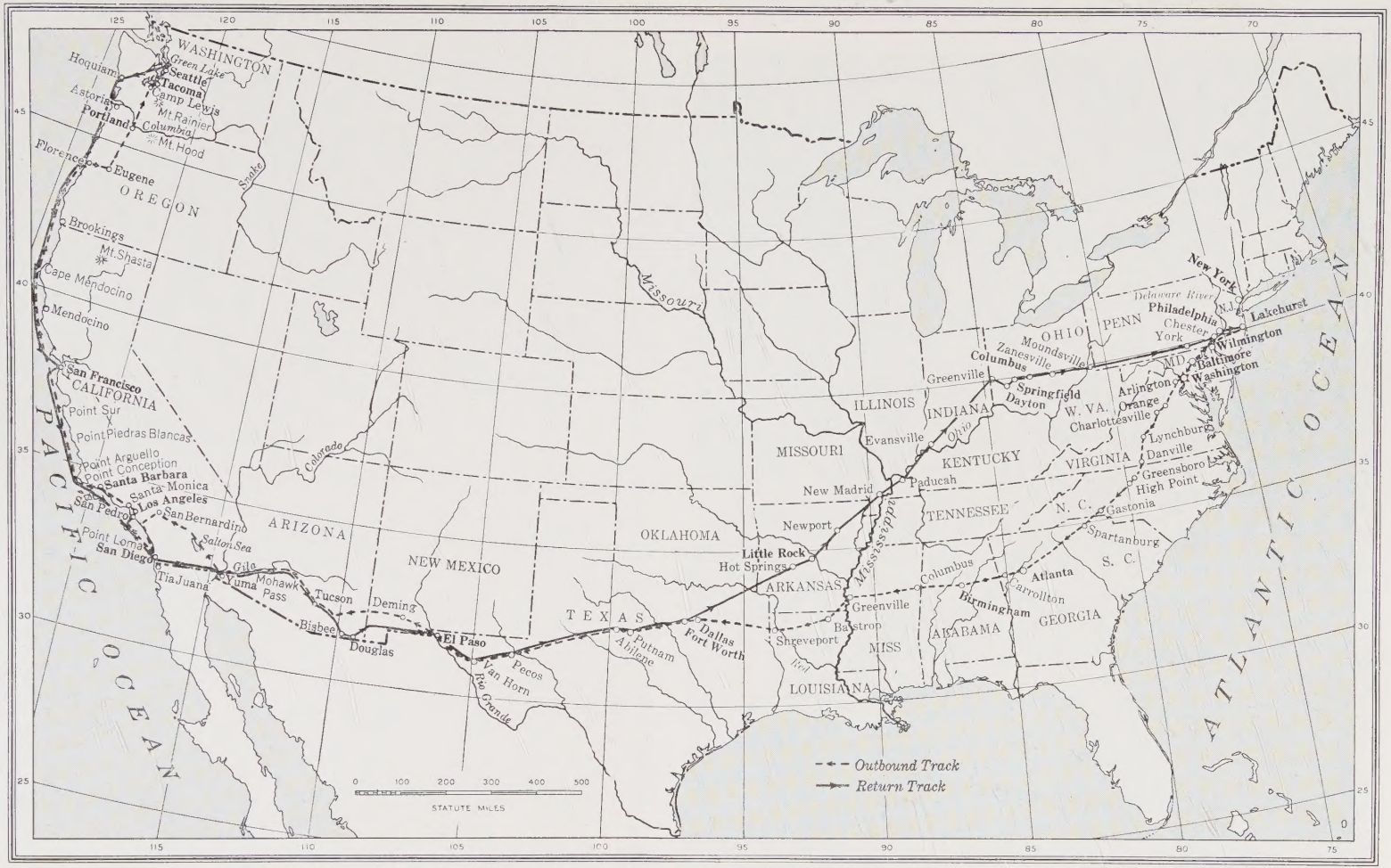
THE AUTHOR CHATS WITH COMMANDER LANSDOWNE

"Lansdowne is one of the type who foresees difficulties and does not get excited, but deftly and quietly avoids them" (see text, page 7). Mr. Wood had to discard his pipe, as smoking is not permitted on board.

Photograph by International

THE COMMANDER ON THE GANGPLANK OF HIS SHIP

Concealed in a door under the ship's nose, the gangplank leads to the 9-inch-wide runway, or "cat's walk," which occupies the center of the long keel, from nose to tail fins (see diagram, page 8).



THE TRANSCONTINENTAL ROUTES OF THE "SHENANDOAH" ON ITS RECORD-MAKING VOYAGE

The American-built, American-manned airship, having on board Rear Admiral William A. Moffett, chief of the Navy's Bureau of Aëronautics, a personnel of 11 officers and 27 men, and the author as the sole civilian observer, sailed from Lakehurst, New Jersey, at 10 o'clock on the morning of October 7. After a voyage of more than 9,000 miles, the giant craft returned to its airport of debarkation and anchored safely at 11:55 p. m., October 25.

Official Photograph, U. S. Navy

REAR ADMIRAL MOFFETT (IN THE REAR) AND LIEUTENANT COMMANDER LANSDOWNE IN THE NAVIGATING GONDOLA

Admiral Moffett has been the leading advocate of the practicability of the helium-filled airship for passenger traffic and exploration, claiming that the use of helium eliminates the danger of explosion, and the invention of the mooring mast on land and on convoy ships has simplified the difficult problem of airship terminals.

and an expurgated assortment of toilet articles had replaced a wardrobe trunk. A typewriter had gone aboard as ship equipment.

The Navy has orders against everything; also ways of doing everything without violating orders. The clothing problem was solved by wearing two lightweight instead of one heavy suit. On warm days one suit could be peeled snakelike. A fur-lined flying suit, mittens, and boots were ship stores.

"Tell Mr. Wood to come aboard," came the order after a minute which seemed an hour.

"Glad to see you aboard," said Lieutenant Charles E. Bauch, assistant keel officer, in real ship greeting. His tall form stooped in the narrowing forward end of the tube. He waved a hand in the general direction of the dim aft.

"The captain says to go down the ladder into the control car," he said. "Leave your kit here until we get under way."

To the person who has lived a lifetime with his feet never more than a few inches from the ground or from a structure in close contact with Mother Earth, the mere idea of soaring through the air seems the great feat, overshadowing all other details. To the aviator, at home in the air and in high altitudes, the working of his motors is the ever-present consideration. To the lighter-than-air navigator come all these problems and the greater one of the buoyancy of his craft.

While in motion, the engines and the horizontal rudders, called "elevators," can aid in holding it aloft. When stationary, they are of no assistance. The gas alone must lift the load.

Sailing several thousand feet in the air

Photograph by Junius B. Wood

IN THE "BRIDGE," OR NAVIGATING GONDOLA

Lieutenant Commander Lewis Hancock, Jr., the executive and navigating officer, is plotting the course; Lieutenant John B. Lawrence holds the steering wheel; and Chief Petty Officer F. J. Tobin grasps the wheel which controls the "elevators," or horizontal rudders. The radio "shack," in reality a separate gondola, is so close to the forward navigating gondola that, from the outside, it appears to be the tail end of the latter (see text, page 32).

is comparatively simple. Making a landing and casting off are the difficult parts of airship navigation. It is somewhat like docking a ship, only for the more delicate airship there can be no crunching of fenders or rubbing of piers by steel hulls.

THE CRITICAL OPERATION OF CASTING OFF

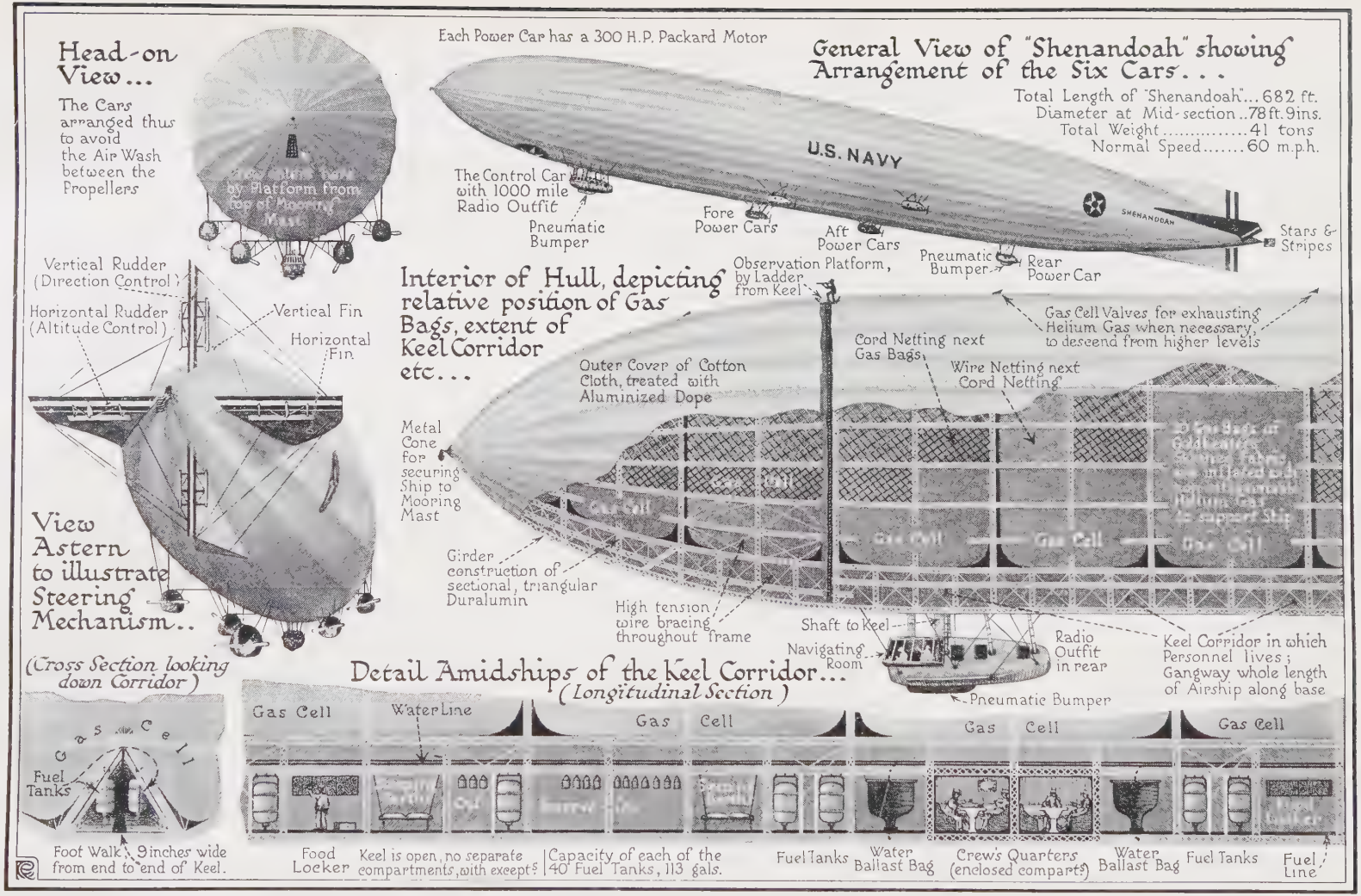
No one who is not needed is on the "bridge," the forward navigating gondola, during those critical operations. The others are at their designated "landing stations" or being shifted back and forth along the keel, human plummets, to keep the long tube balanced. Water is dropped in spurts of hundreds of pounds when the ship is heavy. In an emergency, even a gasoline tank may go. Men are shifted again to keep the balance. The ship must rise when it casts off, only for a few seconds, until the propellers have caught hold, but enough to clear the mast, which would cut its thin sides like a knife.

Rear Admiral William A. Moffett, chief of the Navy Bureau of Aëronautics, was in the rear of the little cabin as I squeezed down the ladder. I was the only passenger until the mountains had been crossed and San Diego reached.

Casting off from a mast is much the same, wherever the location. The day in San Diego, October 22, had all the picturesque features and its story illustrates the intricacies and skill involved in the operation of one of these giant ships of the air.

Lieutenant Commander Lansdowne sat in one of the forward windows of the gondola. Lansdowne is one of the type who foresees difficulties and does not get excited, but deftly and quietly avoids them.

Lieutenant Commander Lewis Hancock, Jr., executive officer and navigator, was close by; Lieutenant John B. Lawrence held the steering wheel; Lieutenant A. R. Houghton was officer of the deck,


Head-on View...
The Cars arranged thus to avoid the Air Wash between the Propellers
Each Power Car has a 300 H.P. Packard Motor
General View of "Shenandoah" showing Arrangement of the Six Cars...
Total Length of "Shenandoah"...682 ft.
Diameter at Mid-section..78 ft. 9 ins.
Total Weight.....41 tons
Normal Speed.....60 m.p.h.
U.S. NAVY
SHENANDOAH
The Control Car with 1000 mile Radio Outfit
Pneumatic Bumper
Fore Power Cars
Aft Power Cars
Pneumatic Bumper
Rear Power Car
Stars & Stripes
Vertical Rudder (Direction Control)
Horizontal Rudder (Altitude Control)
Vertical Fin
Horizontal Fin
View Astern to illustrate Steering Mechanism...
(Cross Section looking down Corridor)
Interior of Hull, depicting relative position of Gas Bags, extent of Keel Corridor etc...
Observation Platform, by Ladder from Keel
Gas Cell Valves for exhausting Helium Gas when necessary, to descend from higher levels
Cord Netting next Gas Bags
Wire Netting next Cord Netting
Outer Cover of Cotton Cloth, treated with Aluminized Dope
Metal Cone for securing Ship to Mooring Mast
Girder construction of sectional, triangular Duralumin
High tension wire bracing throughout frame
Shaft to Keel
Navigating Room
Radio Outfit in rear
Pneumatic Bumper
Keel Corridor in which Personnel lives; Gangway whole length of Airship along base
Detail Amidships of the Keel Corridor...
(Longitudinal Section)
Gas Cell
Fuel Tanks
Water Line
Gas Cell
Gas Cell
Gas Cell
Foot Walk, 9 inches wide from end to end of Keel.
Food Locker
Keel is open, no separate compartments, with exceptions
Capacity of each of the 40 Fuel Tanks, 113 gals.
Fuel Tanks
Water Ballast Bag
Crew's Quarters (enclosed compartments)
Water Ballast Bag
Fuel Tanks
Fuel Line

© National Geographic Society

Drawn by Charles E. Riddiford

A PICTORIAL DIAGRAM OF THE SHIP THAT MADE THE HISTORIC FLIGHT

Note especially the "cat's walk," in the lower left corner. This narrow, railing-less plank is the only means by which the officers and crew can go from one end of the airship to the other. The thin cotton covering, 12 inches below, gives a false sense of security; the ground, usually 3,000 feet down, is only two steps removed. On the return voyage from the Pacific coast, one man made the first "step," as a stitched rent in the cloth shows (see text, page 23). At night the "cat's walk" is unlighted.

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SAYING FAREWELL TO THE WHITE HOUSE

On its flight to the Pacific, the big aircraft passed between the Washington Monument and the White House at 2:10 p. m., four hours after leaving Lakehurst, New Jersey. The White House is in the left foreground, and just beyond it, the Treasury. In the right background, Pennsylvania Avenue stretches to the Capitol, dimly seen in the distance.

Photograph by Pacific and Atlantic

SALUTING THE UNITED STATES CAPITOL

On its memorable first visit to Washington, D. C., the *Shenandoah* flew over the Capitol, dropped flowers on the grave of the Unknown Soldier at Arlington, then proceeded to Mount Vernon to salute the tomb of Washington. Since that time, this airship has become America's best-known vehicle, for hundreds of thousands of spectators have watched its silvery form as it cruised back and forth across the continent.

with hands and eyes on the network of handles which empty ballast bags, and Chief Petty Officer L. E. Allenly was at the wheel of the "elevators," or horizontal rudders.

"We must weigh off right away, before we start to lose our superheat," Captain Lansdowne announces.

"Can tell from the mast that we're heavy aft, sir," Allenly reports.

"What water can we drop?" Lansdowne demands.

"We have three emergency bags aft and two forward," Lieutenant Houghton replies.

"You can drop any in the afterpart, sir," says Lieutenant Roland G. Mayer, keel officer.

"What's at frame 40?" Lansdowne asks.

"Four hundred pounds extra at 40, sir," Mayer replies.

"Clear away aft," Lansdowne orders through his little megaphone.

"Are we light?" asks Lieutenant Lawrence. Nobody answers.

"Still putting oil aboard, sir," comes a voice from the mast.

"Idle engines," Lansdowne orders in a sort of resigned voice. The few extra pounds of fuel must be crowded aboard.

"Idle engines, sir," echoes Lieutenant E. W. Sheppard, the engineer officer, holding the signal levers.

The dials are the same as on the bridge of a ship, but there is a lever for each engine in the five separate gondolas. Sheppard swings two handfuls of levers with one motion. The bells ring and repeat as the levers fly back and the men in the gondolas acknowledge the signal.

"Ship at least 300 pounds light," says the mast. "Last fuel coming aboard, sir."

"Very well; shut off fuel," Lansdowne

Photograph by Pacific and Atlantic

THE NIGHT ARRIVAL AT FORT WORTH, TEXAS

The airship reached its mast at Fort Worth at 8:30 p. m., October 8, but an hour elapsed before it cooled sufficiently to approach low enough to drop its cable (see text, page 26). Fort Worth is the home of helium gas, noninflammable and nonpoisonous, of which the United States possesses the only known source of considerable supply. It is extracted from natural gas (p. 98).

assents. "Secure the water line up there," he adds in a louder voice.

"Aye, aye, sir," the mast replies.

"We're now falling off to the right," says Lieutenant Lawrence, at the steering wheel. Four minutes have been consumed in the jockeying.

"How's the ship?" Lansdowne demands from an officer on the top of the mast.

"Still heavy, sir."

"Let me know when she's light," in a nonchalant voice. Everybody waits quietly; no strain; the ship will rise; only patience is required.

"Elevators neutral, sir," Commander Hancock announces.

"Neutral, sir," Allenly echoes. That means the ship is in equilibrium.

"A cloud is coming over the ship," Houghton announces.

"We'll have the sun again in a few minutes," Lansdowne adds, as if to himself.

"Are all hands on their landing stations?" he suddenly asks.

"On their stations, sir," Commander Hancock reports.

"She's coming up now, captain," from the mast.

No more questions; no more conversation. Two more minutes have gone.

"Have an inversion of temperature aloft," the voice from the mast breaks the silence. It is a warning that the ship's buoyance will change as soon as she rises.

"Thank you," replies Lansdowne. "How high?"

"Only up to 2,000 feet."

"How many degrees? Considerable?" Lieutenant Lawrence inquires.

Lansdowne repeats the question. It is not answered. No time. The cloud has passed. The ship is picking up as the sun strikes it again. An opportunity may come in the tick of a second when she can slip away from the mast.

Photograph by Pacific and Atlantic

LEAVING FORT WORTH

"This big airship is in reality a flying laboratory, which by its construction and operation is developing not only a new element in the national defense, but is testing the efficiency and adaptability of allied industries which in time will become of extreme importance in the utilization of air navigation as a commercial enterprise."—*Lieutenant Commander Lansdowne.*

"Is the ship light?" Lansdowne asks.

"Not yet, sir," the mast replies.

"Is her nose secure? Is Rosendahl aboard?" he asks in a single breath.

"Yes, sir; she's just about in equilibrium," Lieutenant C. E. Rosendahl replies, without regard to sequence, as he comes down the ladder.

"Let me know the minute she is light," Lansdowne requests.

"About equilibrium," the mast replies.

"Let go as soon as she will lift out of the cone," he orders.

"Stand by the water for emergency aft," Commander Hancock orders.

Lieutenant Houghton grips two of the handles more firmly. One pull and 550 pounds will be dropped by each.

"Elevators amidships, Allenly," Lansdowne orders.

"Tail's a little down, sir," the mast advises.

"Take your time," Lansdowne replies. "I don't want to get off heavy."

Everybody knows that the clamps, which fit like bent fingers into the rim of the cone, have been released, and that the big ship, gently balancing her length on the still air, will float free from the mast like a feather.

"Five seconds on 110," Lansdowne orders.

Houghton switches handles and pulls. Five seconds spill 300 pounds of water ballast. In the keel 2,200-pound rubber bags hang on each side of frames 40, 100, 110, and 170. Each of them drops 30 pounds a second when a handle in the control car is pulled. Four emergency bags are at frames 30 and 180 and two at 194, each of which drops 550 pounds of water ballast in one splash.

Only 300 pounds lighter, but she starts to rise.

"Free, captain!" comes a shout from the mast.

THE SHIP STARTS TO SETTLE

The ship sways just a little more. Slowly she starts to settle, as she falls away from the supporting mast.

"Water forward!" Lansdowne exclaims, sliding from the window to his feet.

Her nose stops, poised and almost imperceptibly starts upward. Aft she is still dropping.

"Water aft!" he exclaims. Houghton is pulling handles and water is pouring on the ground. She teeters like a swing board.

Photograph by Junius B. Wood

LOOKING DOWN 6,000 FEET INTO IMPERIAL VALLEY

The radio is stilled a moment, while Radio Gunner George W. Almour, who, with Lieutenant Carlton D. Palmer, maintained communications, leans outside the door of the radio "shack." The *Shenandoah* established radio communications on the short waves with some 200 amateur stations in 39 States. It communicated also with 14 Navy, 6 Army, and 6 commercial stations, and sent and received 45,332 words during the 258 hours it was in the air (see text, page 30).

"Water again, forward, quickly!" Lansdowne says, almost excited.

"Standard speed," he adds. Her nose has drifted back from the mast. The drive ahead can be risked.

"Standard speed, sir," Sheppard echoes. The levers click, bells jangle and repeat, as the levers fly back again. Quicker than it can be told, the men, hands on the throttles in five separate cars, like one machine, have their motors roaring at 1,200 revolutions a minute.

Slowly the ship gathers headway. She seems to hesitate, as if reluctant to leave, holding her nose toward the ground.

"Pull the water in her nose," Lansdowne snaps.

"Pulled, sir," Houghton echoes, as 550 pounds more drop in a single splash, spraying the windows of the forward car.

The nose bobs upward from the released ballast. It is equivalent to dropping three men. One man walking the length of the ship when the engines are not running changes her level 3 degrees, so carefully is she balanced. After she is under way they can move at will, the elevators by their resistance to the air keeping her trim. However, men cannot be dropped overboard to lighten the ship. Men, engines, and a certain amount of fuel and oil are not classed as "disposable" ballast.

"Two more men aft," he adds in the same breath.

"How far, sir?" asks Lieutenant Mayer, as he runs up the ladder.

"All the way."

"A man from 105 and a man from 60, into the tail," is shouted down the long keel tunnel. The vibration of the motors drowns the thud of their feet, as they race uphill along the narrow runway.

The ship is rapidly gathering headway. Her nose is pointing upward at an angle of 10 degrees.

"She's all right," Commander Hancock vouchsafes.

"Watch your rudders," cautions Lieutenant Rosendahl, with an eye on the

Official Photograph, U. S. Navy

RESTING AT SAN DIEGO BEFORE BEGINNING THE FLIGHT NORTH

From end to end the airship is equal to nearly three average city blocks, and at its widest portion there is sufficient space to house a five-story building with a frontage of 50 feet and a depth of 100 feet. Its length is two-thirds that of the *Leviathan,* yet its weight is only 41 tons, compared to the *Leviathan's* 50,000 tons.

Official Photograph, U. S. Navy

THE FIRST RIGID AIRSHIP TO VISIT OUR PACIFIC COAST

The ship reached the North Island naval air station at 10:48 p. m., October 10, but was not moored until 1 a. m. The only accident of the cruise occurred during this landing, in which the rear gondola struck the ground. The jolt buckled one of the girders in the triangular runway (see diagram, page 8). The girder was replaced while the ship was at the mast, and though five days were necessary for the work, it proved that major repairs could be made at a mooring mast (see text, page 37).

Official Photograph, U. S. Navy

SAN DIEGO RESIDENTS GETTING THEIR FIRST VIEW OF A RIGID AIRSHIP

Before beginning the fabrication of the *Shenandoah's* frame, it was necessary to produce a new metallic substance, duralumin, an alloy of aluminum and copper, with the strength of steel and the lightness of aluminum. If the tips of a girder of duralumin 16 feet long and so light that it could be balanced upon one's little finger, are placed on blocks, it will bear the load of eight men sitting upon it.

mast which he has just left and which the ship's tail seems to be clearing by inches.

"Stand by to cut out fuel tanks," Lansdowne orders, and Bauch scampers up the ladder, pulling the cutting pliers from his pocket.

Even fuel must go if necessary. The speeding motors can increase the ship's lift 10 per cent, but that means tipping her nose upward by means of the elevators. After an angle of 13 degrees is reached, the maximum lift is obtained and the only relief is to drop ballast.

CASTING OFF TAKES 16 MINUTES

The casting off, including the interruptions from clouds and delayed fuel, had taken only 16 minutes. The waiting until the sun generated sufficient heat was of several hours.

"Climb as fast as you can," Lansdowne orders.

"She's climbing, sir," responds Allenly at the wheel.

Patches of mist lie over the bay. The city seems too near for comfort. Automobiles and persons around the mast are becoming specks.

"She's 500 feet above the mast, sir," says Hancock, as we circle upward.

"Keep her climbing," Lansdowne repeats.

"How high, sir?" Houghton asks.

"As high as she'll go, Regg," the skipper replies, as the tension relaxes. "Take her to pressure height."

Pressure height usually is 4,500 feet—that is, if the ship starts with her bags 85 per cent full of helium. As she ascends into more rarefied atmosphere the gas expands, keel officers and riggers pulling and straightening the bags, until at 4,500 feet they are full. Through the keel, in the apex of the triangular tunnel, runs a big rubber pipe, connected with each of the 20 bags. When the twine which closes their mouths is unwrapped, the gas circulates from one to another until the pressure in each is equal.

Official Photograph, U. S. Navy

THE BASKET ELEVATOR ASCENDING THE SAN DIEGO MOORING MAST

While the nose rests on the mooring mast, extreme care must be used in boarding the ship in order not to disturb the delicate balance (see text, page 1). Naval authorities admit that, with all its remarkable accomplishments, the *Shenandoah* is an experimental airship, and that new developments and refinements will produce superior craft.

At 4,500 feet, bags and pipe are swollen almost to bursting. Higher than that, the straining gas escapes through safety valves and the ship's lifting capacity diminishes. The load must be reduced a proportionate amount.

Casting off and mooring are much the same operations, only reversed. In each the ship is headed into the wind; it is balanced along its length, so as to be parallel with the ground, and put out of equilibrium, so as to be light or heavy, according to whether the ship is leaving or landing. In casting off, ballast is dropped to make the ship lighter. In landing, gas is valved to make the craft heavier. The engines are of no assistance in lifting until after the ship is free from the mast, or in landing after its downward drive has stopped.

HELIUM IS TOO EXPENSIVE TO RELEASE FREQUENTLY

As the noncombustible helium gas which the Navy uses costs $55 or more per 1,000 cubic feet, valving is frowned on. With the dangerous, but inexpensive, hydrogen, landing can be made almost at will. Similar liberal valving of helium would cost from $5,000 to $20,000

Photograph by International

GOING ABOARD AT THE NORTH ISLAND AIR STATION: SAN DIEGO

Three of the officers are being hoisted to the top of the 173-foot mooring mast (see also illustrations, pages 17 and 19) to board the ship for its northern cruise along the Pacific coast. Storms and head winds caused this trip to be prolonged for more than 57 hours, including the time consumed at Tacoma to avoid the valving of helium.

for each landing. Consequently, advantage is taken of Nature's changes. Landings are made at night, when the ship is cool and heavy, and departures well after sunrise, when the gas is superheated and light.

The gas is extremely sensitive to temperature. Frequently, even as late as midnight, when the ship drops within 300 feet of the ground and the engines cannot be used to drive it farther, it bounces up again like a rubber ball, from the heat still in the earth.

Temperature of the ground, in addition to wind velocity and direction, is always ascertained before attempting a landing.

To make a landing, a crew of 200 or 300 men is needed to hold the ship down. To make a mooring at a mast, a dozen men on the ground are sufficient to couple the two cables and start the machinery. To lead a ship out of a hangar requires the same ground crew of several hundred. To cast off from a mast, the only assistance required from outside is to uncouple the gas, fuel, and water pipes and snap back the clamp holding the ship's nose.

The engines help to drive the ship down until it is within a certain distance of the ground. If it is going directly to the mast, a steel cable is dropped, which the men below couple to one from the top of the mast; the ship rises again and a dummy engine pulls its nose down to the mast.

If the ship is going to land on the ground, ropes are dropped, and the ground crew swarms on them like flies as soon as they are within reach. A trained crew is required.

In the fraction of a second that the ship is stationary—the infinitesimal pause between the time engines are driving it down at 45 miles an hour and the buoyant gas starts to shoot it up again—dozens of men must grab the rope and hang on. A second too early would knock them over, as if catching an express train, and an instant too late would skyrocket them heavenward.

An enthusiastic Filipino messboy jumped and grabbed a rope once and rose 30 feet before he could let go. He awoke in the station hospital.

The record of Chief Petty Officer O'Shea is famous in Navy annals. O'Shea held one rope of a basketless free balloon and some 40 men held the other.

"Let go!" shouted the captain to O'Shea.

"Let go!" echoed the 40 gobs. They did. Like a flash, O'Shea was 100 feet above the ground, at the end of a 40-foot rope. Before it occurred to him to let go, he was several hundred feet higher, and it then was too late. O'Shea started following the rope hand over hand. The balloon was shooting up like a rocket, and if O'Shea's "think tank" was slow, it was determined and unflustered. The last his comrades saw of him before he was a disappearing speck, he had almost reached the bull ring under the bag.

A near-by observatory reported that he was a chilly 14,000 feet high when he gave up trying to reach the flapping valve rope and started to rip the side of the balloon.

It started down in wild circles, O'Shea now on top and again on the bottom. The flapping bag caught in the net, parachuting a few hundred feet, then rolling into a ball and dropping like lead for a thousand, unfolding again into a glide, until finally O'Shea landed, fortunately, in a river. He could not swim, but was fished out, asked for a cigarette, and made no comments.

Later, O'Shea became so excited over an argument with his wife that he piloted a balloon over the family home and dropped the sand ballast, without bothering to take it from the bags, with such accuracy that a hit was made through the kitchen roof at the busiest hour of wash day. O'Shea was retired from the service, but his experience is part of

Photograph by International

A CLOSE-UP OF THE "SHENANDOAH" HITCHED TO HER MOORING MAST

The swivel pear on the ship's nose fits into a cup on the tower. In mooring, a cable is dropped from the ship to the ground and is hooked to another trailing from the mast. A winch pulls the ship down until its nose meets the clamp. The gangplank door (see illustration, page 4) is here shown closed. The *Shenandoah's* "wild night" during the storm of January 16-17, 1924, in which the ship broke from its mooring, is regarded by aviation authorities as one of the best possible tests of ship and mast that could have occurred.

Official Photograph, U. S. Navy

OVER THE PACIFIC OFF POINT LOMA

"The weather was raw and hazy, with head winds down the coast, when the *Shenandoah* cast off from San Diego mast. . . . Fifteen minutes later she had rounded Point Loma and was headed northward, over the Pacific Ocean, and 5 miles offshore" (see text, page 39). Captain Stanford E. Moses, commander of the air squadron of the battle fleet; Lieutenant Commander R. D. Kirkpatrick, battle fleet aviation officer, and Joe Johnson, moving-picture operator, joined the ship for the cruise to Tacoma.

lighter-than-air curriculum, as illustrating the danger of grasping airship guy ropes without holding the motion open for immediate reconsideration.

FLYING OVER NEW JERSEY, PENNSYLVANIA, AND DELAWARE

As the *Shenandoah* left her home mooring mast at Lakehurst, 10 a. m., October 7, she described a broad circle with a 5-mile radius, until the altimeter on her "bridge" showed 1,300 feet. That was the level above the sea, and in New Jersey it meant practically the same above the ground. A few days later, when the same altimeter registered 7,300 feet, going through the Rocky Mountains, she was only a few hundred feet above the bottom of the canyon and the menacing peaks on either side were above her.

Jersey, with its little lakes and big hotels, patches of fertile farms and smoky cities, miles of stunted pine and cranberry bogs, was left behind when the Delaware River, opposite Chester, Pennsylvania, was reached at 11:25. The *Shenandoah* followed the river, her shadow trailing below like a big fish on its surface, until Wilmington, Delaware, was passed, 20 minutes later. Baltimore was below at 1:37 p. m.

Going 55 miles an hour, the start and finish of a race at Laurel were seen from a safe altitude of 3,000 feet. An escort of airplanes came out from Washington, the ship passed between the Monument and the White House at 2:10, and the District of Columbia was crossed in 10 minutes (see page 9).

THE EARTH SEEMED COVERED WITH RUGS AND CARPETS

As she sailed along over the low, rolling hills of Virginia, straight into a fire-red sun whose last rays were tinting the tops of the forests in gay autumn hues of red and yellow, the first purple haze of evening had fallen on the streaked brown fields and green pastures in the valleys.

From the skies the undulating earth seemed covered with carpets in drab and green and rugs of bright colors, cut into squares and strange shapes and marked with strings of white, which were highways.

Darkness fell below while the sun still was striking through the windows of the navigating gondola. The ship was over Orange, Virginia, at 3:59 p. m., Charlottesville at 4:35, Esmont at 5, Norwood at 5:30, and Lynchburg at 6:20. Danville, Virginia, was below at 8:10, and a few minutes later the *Shenandoah* was sailing over North Carolina.

Under the moonlight, the tree-covered earth, with an occasional light which twinkled and disappeared, lay black and mysterious below. Several aboard had drifted over that country in balloons and had memories of rifles which spat from below and bullets which punctured gas bags. One balloon had returned to its station with 17 holes. Possibly residents in those lonesome hills were suspicious of spies from the sky, looking for moonshine stills which were inaccessible to revenue agents below.

In the silent night the hum of the *Shenandoah,* as she passed high in the air, could be heard for miles, but no hostile bullets greeted her.

FEW LIGHTS GLOW ON THE SHIP AT NIGHT

Greensboro was an electric cluster in a black setting at 9:20 p. m., High Point was 1,000 feet below at 9:55, a dozen colored flares burning in a greeting which was easily understood, and Salisbury followed an hour later with a salvo of locomotive whistles from Spencer into town, dimly echoing to the ship. Gastonia, North Carolina, was a fading glow at 12:37 a. m., October 8, and at 1:27 Gaffney, South Carolina, was directly below.

In the navigating gondola the electric light over the chart table was flashed on only to glance at a map or make an entry in the log. A faint glow came from the little bulbs behind the spirit levels and compass.

White running lights were on the forward and aft gondolas, green lights on the two starboard cars, and red on the two on the port side. Within, all was dark, except for a moment on the bridge or for the glow from electric torches in the long tunnel in the keel, as men passed back and forth, changing watch in the engine cars, measuring fuel tanks, inspecting motors and gas bags, and performing other tasks which required constant vigilance.

The ship is not wired for lights. Only those in the navigating room, in the radio

Official Photograph, U. S. Navy

OFF NEWPORT BEACH SOUTH OF SAN PEDRO, CALIFORNIA

shack, and the running lights are on batteries. Each individual carries his own torch. Though helium gas will not burn, no fire is permitted aboard. The only sparks are in the six motors—one runs the radio generator—and in the little two-burner gasoline cookstove in the latter's closet.

In the dark the long keel is eerie with phosphorescent figures and letters, which glow from every latticed frame or piece of emergency gear, with lights which flash in the distance and disappear and lights which suddenly appear from nowhere, while one fur-padded form leans at a danger angle and another passes on the ribbon of a runway.

Day and night the life of the airship is in the keel. It is a triangular tunnel running the length of the ship. Its base is the thin cotton bottom panel of the outer covering of the big tube; its equilateral sides are the gas bags, when they strain full against the wire and twine network which holds them in place.

"THE CAT'S WALK"

In the center, 682 feet long from nose to tail fins, is the runway, 9 inches wide. It is called "the cat's walk," from the skill required to tread it. The thin cotton covering, 12 inches below, gives a false sense of security; but the ground, usually 3,000 feet below, is only two steps removed. A roughly stitched rent in the cotton shows where one man made the first step, and with true sailor veracity the marks of his fingers are shown where he gripped the steel-hardened duralumin to save himself from taking the second step.

No admonitions are needed to walk the straight and narrow path. The crew, as nimble as structural steel workers, trot along, pass each other, and even stop to wrestle.

Four lateral runways pierce the sides of the tube to ladders leading into motor gondolas. Though the runway is precarious, negotiating an uninclosed ladder 3,000 feet above the ground while speeding 70 miles an hour requires cooler nerves.

Men skip up and down and even stand on the gondolas to watch the passing scenery. One night in the mountains the chief on his hourly inspections found a door closed at the bottom of one of the ladders. Considerable kicking made him heard above the din of the motor. He inquired why everything was closed.

"You see, we were so close to the mountains, and I saw some goats and was afraid one might jump in here," the man explained.

HOW THE GAS AND WATER BAGS ARE DISTRIBUTED

Every 5 meters in the tunnel, corresponding to the outer circular ribs, is a triangular frame of latticed girders. In the center of the ship the triangular frames are 12 feet across and 9 feet between base and apex. The sides become shorter in the ends, and heads are bumped and cut by the cross-girders. One bump convinces the most skeptical of the rigidity of the *Shenandoah*.

In the upper angle of the triangle is the rubber gas pipe, wilted and loose or puffed to the size of an 18-inch water main, according to altitude. Flanking it are the metal fuel and water pipes. At the sides, distributed so the load will be equalized through the length, are the 724-pound gasoline tanks, the smaller cans of lubricating oil, and the sleeping bunks for officers and men. One habituated youth slept in a hammock, only the cotton between him and space, as comfortable as if his bed were swung between the towering aërials of the Arlington wireless station.

At intervals along the runway are three decks, little 12-foot-square platforms of thin plywood. One is for the mooring equipment and the other two are euphoniously designated as officers' quarters and crew's quarters. Though discipline does not deteriorate, "side" is lacking on an airship. Instead of a suite of three rooms and private bath and messboy, to which a rear admiral is entitled on a battleship, his private bunk is not different from those of the crew. The same-sized shaving mirrors, the only luxury aboard, hang in both quarters. The rations are the same, the combination cook and messboy is the same, mess hours are whenever anybody has time to eat, and as the food, including the hot soup, is distributed from the crew's quarters, the officers frequently munch their dry sandwiches there.

Official Photograph, U. S. Navy

THE AIRSHIP'S AIRPLANE ESCORT OVER SAN DIEGO

San Diego is the headquarters of the Eleventh Naval District. The southern route from New Jersey to Texas was chosen because it eliminated the necessity of crossing the Rockies at the great heights farther north. The mountain passes required skillful management of the ship; in fact, the navigation of a rigid airship through the atmospheric ocean entails the same expert execution as navigation at sea.

In daytime the keel is fairly light, through the white cotton flooring, which is not blackened inside, as is the remainder of the outer tube.

At night it is dark and mysterious. The emergency dials glow like ghostly faces with cabalistic words and signs, dots and dashes for levers and buttons. The chill wind whistles against the thin covering, and the motors, which never stop, roar right beneath. Silent muffled figures are huddled on the bunks, some wormed into padded sleeping bags, others bundled in fur suits, fur mittens, and wool boots. Lights always are flashing and moving in the dim distance.

HALF THE SHIP SLEEPS WHILE OTHER HALF WORKS

On the crew's deck, lit by a dying electric bulb, will be a group of men who have come off duty—wheelsmen with weary eyes and arms, machinists with ears stuffed with cotton, drinking hot coffee from tiny paper cups—and a chief figuring out his hourly report of the fuel consumed and the gallons of converted water ballast.

While half the ship sleeps, the other half watches and works, day and night, four hours on and four hours off. Other nights were like the first night. The routine never changed any more than did the mad roar of the motors.

Scenery differed with every hour, winds rose and fell, the moon faded from a fat white ball to an emaciated crescent, some nights were foggy and others were clear, but life never varied in that long tunnel, like an uncanny shaft of a mine floating thousands of feet in the air.

Spartanburg, South Carolina, was crossed at 1:57 a. m.

The morning sun was following up over the hilltops, cutting long furrows through the mist hanging in the valleys, before Atlanta was reached. Atlanta was rubbing the sleep out of its eyes at 4:35 a. m. (central time), but, judging by the number on the streets, a large share of

Official Photograph, U. S. Navy

SALUTING THE BATTLE FLEET OFF SOUTHERN CALIFORNIA

"The battle fleet was at target practice, shots ricocheting across the surface, with splashes a mile apart, in San Pedro Channel, off Catalina Island."

the population had left a call, possibly with the fire department, to be awakened when the *Shenandoah* was heard approaching. Carrollton, Georgia, was left behind at 6:32 and the Alabama border crossed a few minutes later.

Long before Birmingham was reached, at 7:15 a. m., the mantle of smoke from her steel mills was visible. Railroads and devious highways wound through the valleys and hills, gullied by freshets of many years, over which the ship was speeding at 55 miles an hour. Three Army airplanes came out to meet her.

Birmingham's whistles could be faintly heard, 2,500 feet below, and nearly every roof on the cluster of skyscrapers in the center of the city was crowded with spectators, their faces white dots in the distance.

From Birmingham to the Black Warrior River the forest seemed without a break.

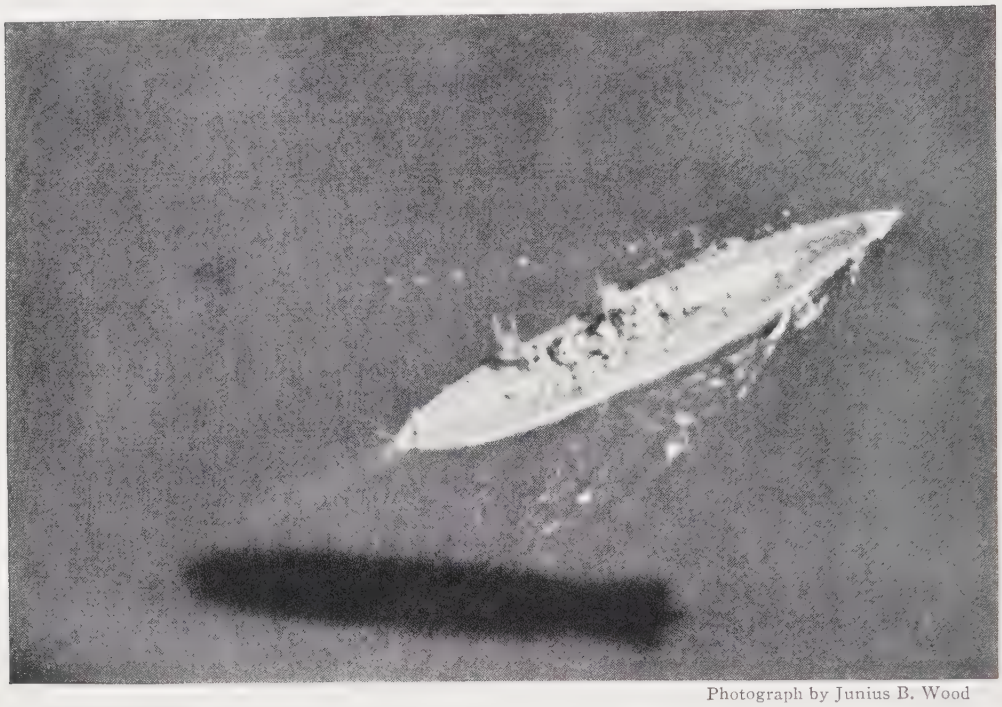
Motors were running at only two-thirds speed, 1,000 revolutions a minute, but the ship was making time, with a fair wind behind.

OVER THE LAND OF COTTON

The Mississippi border was crossed and Columbus was below at 9 a. m. Greenville and the Mississippi River were crossed at 11:47.

Many of the 24 States sailed over had a Columbus and a Greenville on the route. Columbus may have been an omen for a pathfinding ship and one Greenville was the birthplace of Commander Lansdowne.

Through the second day the *Shenandoah* was over the land of cotton. Bas-



Photograph by Junius B. Wood

THE AIRSHIP'S SHADOW PASSES THE U. S. S. "CALIFORNIA"

The flagship of the navy of the air passes the flagship of the battle fleet off San Pedro, California. Greetings were exchanged between Admiral S. S. Robison, commanding the fleet, and Rear Admiral Moffett.

kets of white and scattered groups of darker figures were in the fields, and square bales, dice in the distance, were piled at every railroad station. Clearings around weather-beaten houses with dirt roads faintly visible through the trees would spring out of the forests. Every house seemed to have a family with numerous children. While chickens and cows ran in terrified circles, the children would gaze in awe or wildly wave greetings.

One portly colored citizen—the glasses disclosed him to be such—dashed into the house and reappeared waving a white tablecloth to make sure that he would be noticed.

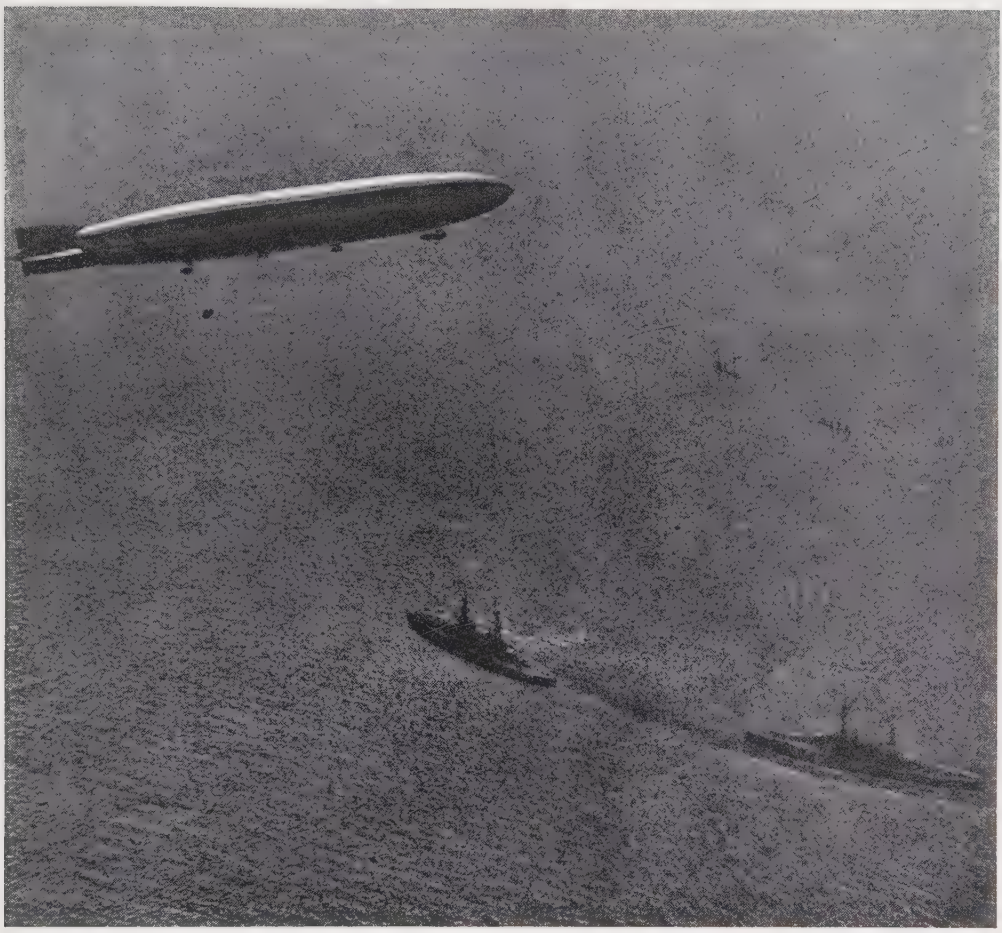
Fires were smoldering through the forests of Louisiana. Columns of smoke rose lazily as high as the ship, and the dull glow of burning brush could be seen through the trees, waiting only a wind to fan the blaze to their tops. It was the same in Arkansas through a night on the return voyage, two weeks later.

The *Shenandoah* was over Bastrop, La., at 2:10 p. m., passed Shreveport and the Red River at 4:15, and was almost to Texas. Night had fallen when the lights of Dallas twinkled below at 7:40 p. m. At 8:30 p. m. she was above the mooring mast, 8 miles outside of Fort Worth. At 9:45 she had cooled sufficiently to approach low enough to drop her cable. The cables were coupled and she rose to be pulled down to the mast.

As frequently happens with new machinery, the winch balked and it was 11:05 p. m. before she was wound down by hand and anchored.

Fort Worth is the home of helium gas, of which the United States claims a monopoly. It is extracted from natural gas, and the Navy's helium plant, in charge of Lieutenant Z. W. Wicks, is about a mile from the mast. Other gas deposits contain helium, but none so far discovered has sufficient quantity to be extracted economically (see also pages 97-99).

Fort Worth was enthusiastic, as was all Texas. So many thousands of the



Official Photograph, U. S. Navy

SAYING GOOD-BY TO THE BATTLE FLEET OFF SAN PEDRO

The silver covering of the big tube is stretched over a skeleton of girders, and comprises 16,000 square yards of heavy cotton cloth. It is painted black inside to mellow the rays of the sun. On the outside, a coat of waterproof aluminum paint shrinks it tight on the frame.

well-known make of automobile which will run in all seasons over Texas plains were entangled in the surrounding fields and roads that many of the shirt-sleeved, sombrero-crowned drivers did not get their families home before daylight.

Fort Worth had a reception committee keyed up for a week of hospitality. It was crestfallen when told that the *Shenandoah* would remain only over night. It was the same on the return voyage.

The president of a West Texas boosters' club, a hearty man whose black hair matched his black frock coat and broad-brimmed black felt hat, had crossed the big State to be present on that occasion. He was only one of several thousand. He preached the gospel of irrigation for the vast open spaces of his end of the State, also for mariners of the air, but his generous offer was declined.

FORT WORTH IS LEFT BEHIND

At 9:46 a. m., October 9, the *Shenandoah* left the mast, circled over Fort Worth, followed the main boulevard, over the schoolhouses with their yards filled with children, over the six-story mansion where Dr. Cook has been allotted a 14 years' residence, and was off toward Tolar.

The difficult leg of the voyage—to cross the Rockies—was starting.

Officers and crew had worked through

Official Photograph, U. S. Navy

FLYING OVER THE RESIDENTIAL SECTION OF WEST LOS ANGELES

This airship comprises many wonder stories of modern science. Direct contributions to its development include new types of radio equipment, new developments in engine design and performance, new operative methods in driving propellers, and new machine-shop methods. Its long cruise tested the practicability of the American innovations added to the plans laid down by Zeppelin.

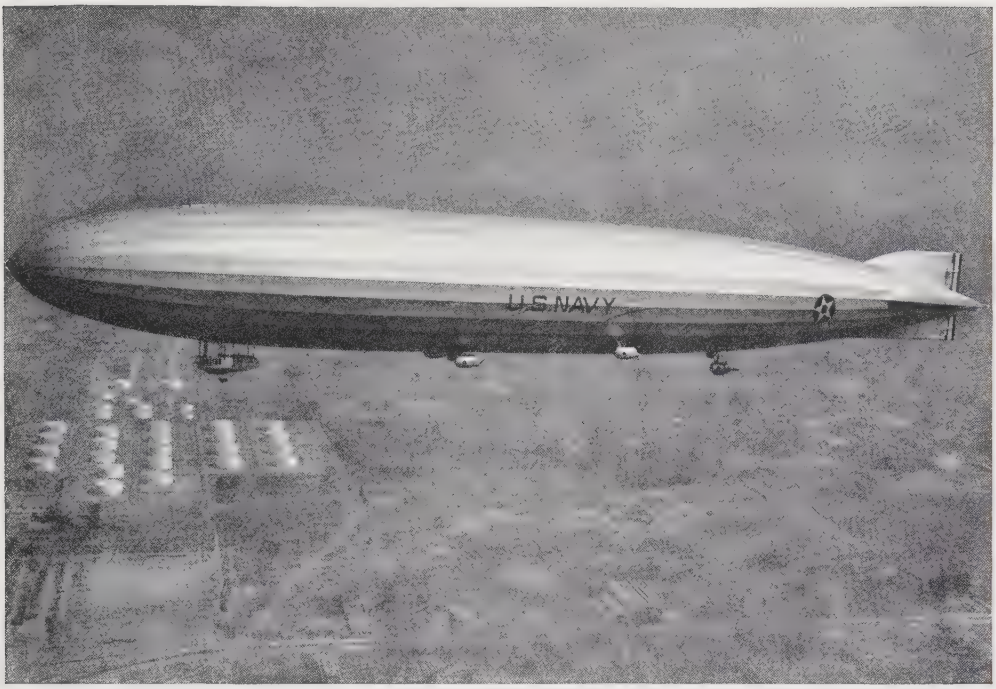
the night and 17,016 pounds of fuel, 850 pounds of oil, and 2,500 pounds of water had been taken aboard. Her gas cells bellied inward, only partially full, along the inside tunnel. As she climbed over the mountains they would be taut, 5,000 cubic feet of gas escaping through the safety valves for every 100 feet of altitude above the pressure height.

Ranger slipped by at 12:45 p. m., Eastland and its oil spindles at 1, Cisco at 1:12, and Putnam at 1:30. In the clear atmosphere which continued through that day and the next to the California border, the horizon was 50 or 75 miles away, and the ship, almost a mile above the surface, could be seen for miles. However, ranchers, accustomed to gazing across the plains, would dash for the nearest windmill and climb its ladder, believing that they could see the ship better.

Another unfailing manifestation in cities was to discover a speck in the center of a street start into sudden motion, disappear under the little square which marked a home, immediately to reappear with a cluster of specks representing the family.

GETTING THE RADIO MESSAGES TO THE AMERICAN PRESS

It seems that all the automobiles in Putnam were on a hill outside the town. Two miles farther the glasses disclosed a dozen cars around a derrick operated by a farm tractor, the drivers watching a freshly struck oil gusher. Five minutes later a railroad train was overtaken in the midst of the plains. It had stopped and crew and passengers were on the ground gazing skyward. School children of Baird, at 1:45, their bright-colored



Official Photograph, U. S. Navy

THE PRIDE OF THE NAVY OVER OIL TANKS IN THE VICINITY OF LOS ANGELES

dresses like blowing flower petals, ran along the street after the ship.

Whistles, which echoed faintly 3,000 feet above, announced Abilene at 2:20 p. m. The population was on the roofs or in the center of the streets. In the railroad pens, sheep and longhorns milled around in fright.

The radio operator aboard had been talking with an amateur in town. He stopped suddenly, explaining when he resumed that he was "out looking at the ship."

This was only one of some 200 amateur operators with whom the ship established communication during the cruise. Thousands of others heard the radio either broadcasting talks from the ship or handling messages by Morse code.

Most of the amateurs were members of the American Radio Relay League, and it will be a revelation to many to know that hundreds of these amateurs are communicating across the country day and night, exchanging serious and frivolous messages, but establishing a great, unseen system of communication which might be a national resource in emergency.

These operators stood by through the cruise, ready to send or receive messages. There was seldom an hour, day or night, that one or more could not be raised. Many were boys, one was a bedridden youth, others were retired telegraph operators, and a few were former Navy operators.

Messages they received were turned over to the telegraph companies or relayed by their own system across the country.

Occasionally they were in towns almost under the ship, but usually they were several miles away. Many were in small villages or in lonesome parts of the country.

Until its call was answered each time, the *Shenandoah* did not know where it was picking up an operator.

One night in Oregon, near midnight, an amateur answered from Dayton, which the Census Bureau credits with a population of 448. "Is the telegraph office open?" he was asked. "No, but there's one 10 miles from here and I'll get it there," he answered. He took the message. The next day, when that item on the *Shenandoah's* cruise had been car-

Official Photograph, U. S. Navy

PASSING OVER CLOVER FIELD, SANTA MONICA, CALIFORNIA, EN ROUTE TO SEATTLE

Both the *Shenandoah* and the *Los Angeles* (formerly the *ZR-3*) are expected to prove mighty factors in scientific investigation for determining the practicability of rigid airships in peace. Note the escorting planes surrounding the big ship.

ried by press associations to all the newspapers of the United States, few who read realized the romance of the message from the air and none knew the many links, not the least of which was that free-hearted 20-mile ride through the chilly night which had started it over the country before dawn.

One lad excitedly "broke" the message which he was receiving to explain "Everybody in town's outside the door and the telegraph manager's here to get it." Another urged haste, as he had "a date with a peach" in an hour.

TRYING TO DISTINGUISH BISBEE FROM DOUGLAS, ARIZONA

In addition to the amateurs, the *Shenandoah* was in communication with fourteen Navy, six Army, and six commercial stations. Not counting messages exchanged by telephone or talks which were broadcast, 45,332 words were sent and received during the 258 hours the

Photograph by Junius B. Wood

THE FERTILE FIELDS OF CARPINTERIA, CALIFORNIA, AS SEEN FROM THE AIR

The surf edges with white the Spanish "Carpenter Shop," named in August, 1769, by Friar Juan de Crespí and his companion pioneers, who found the Indians making dugouts here. The town's famous old grapevine, eight feet in circumference, and the largest in the world, died in 1916, but is preserved for exhibition purposes. The lima bean in California was first raised commercially in the Carpinteria Valley. English walnut and lemon groves thrive in this vicinity.

Shenandoah was in the air. Most of them were weather reports and press messages, the former received and the latter sent.

When the officers are not too busy, talks on the *Shenandoah* and the trip were broadcast at night. These were not announced in advance. Hundreds who picked them up by accident wrote describing their amazement when a voice from the speeding ship sounded over their parlor speaker. Several were in isolated ranch houses or mountain lodges. On account of the clearness of the voice, many inquired whether the messages came from the *Shenandoah* in the air or from a big land station.

The enthusiastic fire chief of Chehalis, Washington, wrote: "It was so foggy when you past over that we couldn't see you, but we rung the fire bell and blowed the sireno, and I ran into the house and put on the earpieces and listened to you talking."

When it was uncertain whether the ship was over Bisbee or Douglas, Arizona, the resourceful Lieutenant Palmer asked his auditors, being sure that he had some, to tell the automobilists in the streets to flash their lights on and off—slow in Bisbee and fast in Douglas. He opened the door of the gondola and leaned out. Headlights already were starting to flash below—fast, slow, and assorted speeds. It was Bisbee, as was later ascertained, but no two persons in Bisbee agreed on what was slow.

THE RADIO EQUIPMENT

The new records which the *Shenandoah* made in radio science were, to a large extent, due to the human factor. Lieutenant Carlton D. Palmer and Radio Gunner George W. Almour, the two operators, are among the most experienced and efficient radio experts in the Navy. One was on duty constantly and several times daily both were operating simultaneously.

Official Photograph, U. S. Navy

SKIRTING THE MOUNTAINS OF THE PACIFIC COAST

This coast is, in general, rugged, the high land in many places rising abruptly from the sea. The same storms which the *Shenandoah* rode through over the Pacific sent ships on the rocks and others to dry docks for repairs.

The radio "shack" is a separate gondola, but so close to the forward navigating gondola that from the outside it appears to be the tail end of that car. The little radio room is reached by a narrow door from the navigating compartment. It was so small that two operators facing their keys and array of tuning dials cannot sit back to back.

The two antennæ hang under the car within a few feet of each other. In a closet between the two compartments is a special-type gasoline engine driving a 60-ampere direct-current generator which charges a 24-volt storage battery. The generator ran 24 hours a day, except once when it was taken down and reassembled in flight.

This closet was also the ship's galley, where the coffee, soup, and beans were heated on two gasoline burners. It was so much smaller than the radio room that two men could not stoop at the same time, let alone sit down.

The main transmitter was a 6-tube Navy aircraft standard type SE-1390, modified to permit the use of telephone. It operated on a continuous frequency range of from 600 to 250 kilocycles. An antenna, 450 feet of copper cable weighted with a 15-pound lead "fish," was dropped for this set.

Photograph by Junius B. Wood

THE BIG SHIP'S SHADOW OVER SUMMERLAND, CALIFORNIA

Once a pleasure resort, Summerland invaded the ocean bed in 1891 and pumped oil out of it. The field was soon completely drilled, however, and only a few wells still remain in operation.

When this set was used for broadcasting, the antenna was reeled in to 216 feet and three tubes were removed, giving a 150-watt output, four-ampere radiation, and 525-meter wave-length. The auxiliary transmitter was the latest type from the Navy's research laboratory at Bellevue, D. C. It used both continuous wave and telephone on 3,332 kilocycles. In addition were four "receivers"—long, intermediate, and short wave and compass, each of seven tubes except the short wave with three.

Actual performances of the auxiliary transmitter and the generator were far greater than the most sanguine had anticipated. It demonstrated the reliability of a lightweight set on aircraft under all conditions. Transmission in the air was four times as far as is possible from the ground. The ship was in communication with the Bellevue laboratory every night, the mountains never interfering, and by chance with the U. S. S. *Canopus,* in the Pacific near the Equator, and with a commercial station in Norway. Before starting, this transmitter was expected to work 500 miles only at night.

THE GEOGRAPHY OF THE TEXAS PLAINS VIEWED FROM THE AIR

The vast open spaces of Texas were breaking into hills half an hour after Abilene was left, at 45 miles an hour. Part of Sweetwater had trekked out of town and the remainder was on roofs and freight cars at 3:14 p. m. Two women and a little girl in bright sunbonnets had climbed a barren hill.

Roscoe, with its little squares of cotton, was below at 3:28, Colorado at 3:55, and Iatan at 4:20.

A train which had been attempting to keep pace gave up the race at the little town consisting of a railroad station, water tank, three houses, and a cattle corral. The first of the foothills of the Rockies had been reached, and the road would curve and climb while the ship sailed straight ahead.

Railroads and highways are straight for a hundred miles in the corrugated-

Photograph by Junius B. Wood

OVER NAVARRO HEAD, CALIFORNIA

This cliff, 405 feet high, lies on the north bank of Navarro River, north of Point Arena, California. "Dogs, whales, and pelicans seemed the only denizens of earth, water, or air which were not terrified by the ship. Dogs barked, while other live stock ran; a pelican followed the ship's shadow on the surface, as if it were a possible fish, while the whales played with it for miles" (see text, page 40).

tin-roof and red-paint belt of Texas and in New Mexico and Arizona as well. From the little cow stations, automobile tracks stretch just as straight across the plains, disappearing in the distance, but showing that life is beyond. Even the cattle paths do not curve as they radiate from the water holes which spot the drab, dry country without regularity or reason.

Big Spring, with the First National Bank roof as an observation tower and the town whistle blowing off steam, dropped back at 4:46. Near Stanton the radio gondola felt a twitch, but the 60-ton ship did not pause. The "fish" at the end of 450 feet of antenna had taken a dive into the dry soil of Texas and stopped. So did the radio. The Navy lost a $50 fish, which was not as serious as the escapade of a "fish" from a flying boat, which entangled itself in the skirts of a buxom spectator, and a solemn Navy board is still endeavoring to adjudicate the damages to fish and calf.

Though the *Shenandoah* was climbing, the ground was coming up faster.

Midland, with the Llano Hotel as a roof garden, was below at 6:47, Odessa 30 minutes later, and at 7:50 the Pecos, both river and town, were crossed at an altitude of 4,500 feet. At 9:50 she was over Van Horn, with an altitude of 6,600 feet, and still climbing. Ears sung from the rarefied air.

EVERY MAN ON DUTY AS THE SHIP SPED TOWARD THE MOUNTAIN PASS

The ship was lighter, from the fuel which had been consumed in the 12 hours from Fort Worth, and the gas was cooled both by the chill night and by the 74-miles-an-hour speed; but the bags were swollen and straining against the nets, and gas flowed in a steady stream through the safety valves into the wicker chimneys to the ventilators above.

Water ballast had been dropped until only fuel could be jettisoned to lighten her further.

Photograph by International

THE "STORM DAUGHTER" AGAINST SAN FRANCISCO'S SKYLINE

The ship's nose is over Golden Gate Park. In the central foreground of the picture is the Museum, with Stow Lake to the left center and the Stadium beyond. In the right background, Cliff House may be faintly distinguished. Sea lions disport on the rocks below, and Point Lobos, on which the building stands, received its name from the Spanish *lobos marinos,* or "sea wolves."

The *Shenandoah* was rushing toward the first of the mountain passes, with cross-winds whipping around the peaks and eddying into the valleys below. Every man was on duty.

Half of the officers were in the navigating car. Others patrolled the keel, watching the gas cells or ready to cut out more ballast.

Two men were on duty in each of the motor gondolas. Time was figured in split seconds; each man was ready, so close might be the difference between safety and destruction. Commander Lansdowne was on the "bridge."

The ship was now going through the passes, keeping as low as possible to save gas, but an unforeseen emergency might force her to rise suddenly and go over the ridge.

The clear night with a full moon was almost as bright as day. In the bottom of the valley thin lines of black and white under the moonlight were the railroad and highway on either side. Open fire boxes of passing locomotives sent up a red glow and automobile headlights made long flashes on the road. Red and green pin points of switch lights and the white clusters of tank stations came and

Photograph by Junius B. Wood

OFF MENDOCINO, CALIFORNIA

"To the person who has lived a lifetime with his feet never more than a few inches from the ground, . . . the mere idea of soaring through the air seems the great feat. To the aviator, the working of his motors is the ever-present consideration" (see text, page 6). Casting off and making landings are the critical operations of airship navigation; sailing is comparatively simple.

vanished, as the ship followed its winding course.

The black peaks were above the ship and the brown, furrowed shoulders of the mountains seemed to reach out in the pale light to rub the fragile side of the graceful intruder. They came close, but always fell back.

The eddying wind blew in fierce gusts, which if they had swerved the 682-foot tube, would have dashed it to pieces in the narrow pass.

The lights of Sierra Blanca were below at 10:15 p. m., and the giant ship was speeding through the tortuous channel at 60 miles an hour. Her motors were roaring at full speed, 1,400 revolutions a minute. She responded to her rudders without a quiver, riding as smoothly as a ship on a calm sea.

The line of white road disappeared through the mountains and the black ribbon of steel vanished into a tunnel. The *Shenandoah* climbed and passed over the top. Ahead could be seen the valley of the Rio Grande. The first ridge of the Rockies had been crossed. Fort Hancock, on the river, was below at 10:45, and the course was headed northwest, toward El Paso, skirting the loops of the winding stream and Mexico, lying darkly beyond.

TEXAS IS LEFT BEHIND

El Paso gave a welcome of whistles, flashing flares, and a searchlight, which played on the sides of the ship when she sailed over, at 11:30 p. m., and left Texas behind. Strong winds followed up the valley. She sped across New Mexico at 79 miles an hour, over Deming at 12:10 a. m., October 10, and Lordsburg at 1:32.

When the Arizona line was crossed, at 2:10, the winds changed. The *Shenandoah* fought them until she reached her hangar at Lakehurst, two weeks later.

Bowie, Arizona, was below at 3:07 a. m. The ship's nose was pointed toward the canyon beyond; Dos Cabezos, 7,300 feet high, guarding it on the south, and

the Pinaleno Range, more than 10,000 feet high, on the north.

A 25-miles-an-hour wind was whistling out of the mountain pass. The moon had slipped behind a cloud, and the dim line of railroad which we had been following was no longer visible. The headlight of a locomotive flashed into view far ahead in the pass and the *Shenandoah* drove toward it into the wind. The current caught her broadside. She drifted for a breathless second. The rudders held and she slowly slid forward between the towering peaks, which rose out of the gloom, and into another valley.

"THE WORST OF THE ROCKIES CROSSED"

Cochise was passed at 4:12 a. m., and the even narrower Dragoon Pass was ahead. The lights of the little cattle station of Manzoro were below at 4:30, and the *Shenandoah* was driving into the pass. In the dim starlight it seemed that the mountain walls were within a few feet on either side, and that the long ship could not turn in the narrow defile. A freight train showed the way into the inky tunnel and the ship worked slowly through. Benson, near the summit of the divide, sparkled ahead at 5:19, the east was faintly pink, and the worst of the Rockies had been crossed. Commander Lansdowne climbed the ladder and threw himself on his bunk.

Tucson, thousands of feet below, looked like gaudy stage scenery with its red roofs, green streets, and white walls on a background of brown desert, under the clear morning sun, at 6:30 a. m. If any inhabitants were awake, they were not visible. No life marred the picture. Maricopa at 8:20, Estrella at 9:40, and Gila Bend, with the Gila River a dark-green line through the clouds of dust far to the north. Irrigated farms were green squares on the prevailing brown. From the air, the new Southwest seems to be growing in squares — towns, blocks, houses; farms, fields, and barns—as life is irrigated into the desert.

A passenger train which had kept pace for a couple of hours slowly pulled ahead and disappeared on the long, straight stretch of track. The *Shenandoah* was alone above the dry waste, disturbed only by an occasional jack rabbit hopping around the sentinel cactus and mesquite.

Mohawk Pass, with a few green-roofed houses and black mountains, straight as a wall, went by at 11:42. Just as little breezes toss the dust into patterns, the winds and waters of years had traced giant figures over this dry country, their lines measured in miles. The broad outlines are disclosed only when viewed from the clouds. From the height at which the *Shenandoah* was sailing, the panorama was unbroken for 50 miles in any direction.

The brown ribbon of the Colorado River, with a fringe of green on its east bank, was crossed at 1:55 p. m. Yuma lay across the river to the south.

Dust dimmed the sunlight, even at the ship's altitude, as it entered California and turned northward along the east shore of the Salton Sea.

The Imperial Valley was another irrigated checkerboard of green, its borders fighting against the shifting sands of the desert as tropical clearings do against an ever-encroaching jungle. Indio was reached at 5:15. Darkness fell suddenly.

Rain and snow were driving against the ship when she reached Banning, at 7:05. Sunny California's greeting, which swept in from the San Jacinto Valley, was frigid. The temperature in the forward car dropped to 35 degrees and the ship started to drop from the chill and weight of snow. This quickly melted, and at 8:10 the course turned westward over San Bernardino, reaching the Pacific off Seal Beach at 9:15.

The *Shenandoah* was over the North Island naval air station mast at San Diego at 10:48 p. m., Pacific time. Thirty minutes later she landed on the field, but was not moored at the mast until 1 a. m.

THE ONLY ACCIDENT OF THE CRUISE

The only accident of the cruise occurred in this landing. The guy ropes were dropped and the ground crew pulled the big ship slowly down. It was the crew's first experience with such a job. Urged by the officers inside the forward gondola, they caught and eased it gently to the ground. The rest of the crew, a city block away, seeing a shape as large as a battleship slowly settling toward them, stood back, and the rear gondola met the ground with a sharp bump. The jolt was transmitted through the struts, which

Photograph by Pacific and Atlantic

THE MOORING MAST AT TACOMA, WITH MT. RAINIER IN THE BACKGROUND

In severe storms, the ship will cast off from its moorings and ride around or rise above the disturbance. Ability to do this would be of utmost importance in meeting the difficulties and dangers of Arctic exploration.

anchor gondola and tube, to the framework inside the latter, buckling one of the vertical girders in the triangular runway.

The ship, when on the ground, rests on the rattan and pneumatic cushions under the forward and rear gondolas. The ship, 682 feet ¾ inch long, is 97 feet 1 inch high from bottom bumper to top. The tube is 78 feet 9 inches in diameter at its eight widest frames.

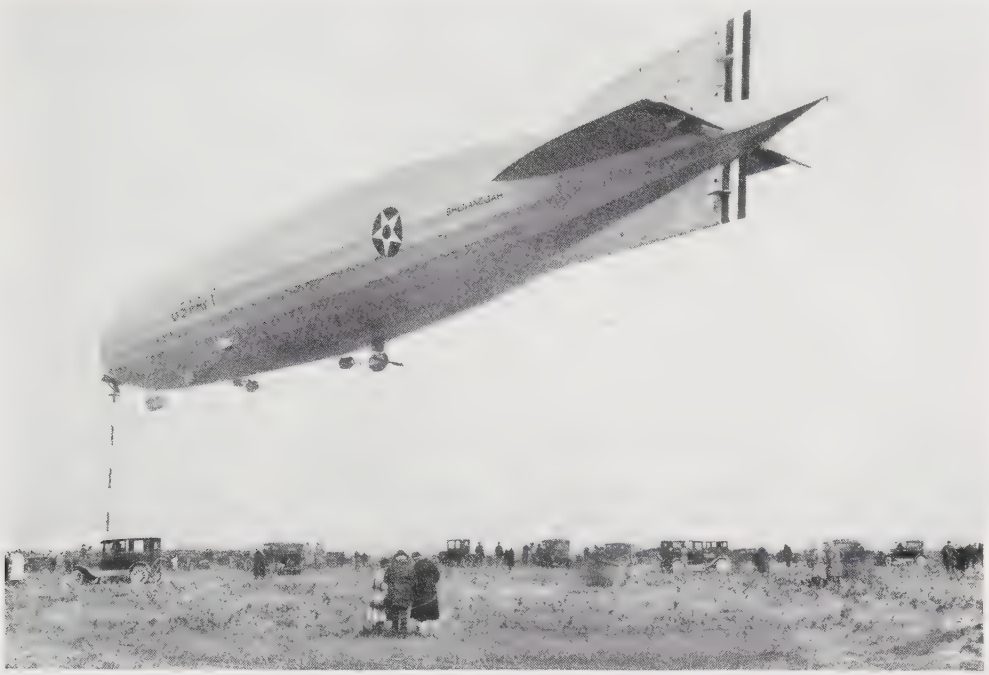
HOW THE "SHENANDOAH" IS BUILT

The crumpled girder was replaced while the ship was at the mast, 150 feet from the ground. All the parts were hauled up by hand. Only two men could work in the cramped quarters at the same time. Five days were necessary, but it showed that major repairs could be made at a mooring mast.

The silvery covering of the tube is stretched over a skeleton of triangular-shaped, latticed girders of duralumin, which is one-third the weight of steel.

The *Shenandoah* was built on the plans of the Zeppelin *L-49*, which came down in the American area in France. Her structural strength was increased, which adds to the weight, but which stood in good stead through the Rockies. An additional frame was added in the center, increasing her length and making possible an increased lift by another gas cell, but not improving her stream line or speed.

The five engines which carried the



Photograph by Boland

THE TETHERED LEVIATHAN OF THE SKIES

In the sunshine over the fog, at Tacoma, the *Shenandoah* was two tons light, and before mooring cruised for 10 hours at 40 miles an hour to keep down. Green Lake was the farthest north of the ship's voyage, and for any airship over the American Continent.

Shenandoah through the mountains are each of 300 horsepower, the two forward, close under the tube, with direct-drive, 11-foot propellers, and the remaining three with propellers 18½ feet in diameter. Two of these are reversible and water-recovery condensers are on three of the motors. They recover from 110 to 122 pounds of water ballast from every 100 pounds of gasoline consumed (see also "Man's Progress in Conquering the Air," in THE GEOGRAPHIC for July, 1924).

The *Shenandoah's* gas cells have a displacement of 2,148,070 cubic feet. Under certain barometric conditions, if filled with hydrogen, they would lift 150,365 pounds, and with helium 85 per cent of that, or 128,884 pounds. As the gas starts to expand as soon as the ship rises, it seldom is more than 85 per cent filled. Under such conditions, the lift of the helium-inflated *Shenandoah* is 109,551 pounds.

The dead weight of the ship, when dry and without water, gasoline, or oil, is 82,000 pounds. This cannot be changed, and the ship must be lightened from the "disposable," in distinction from the "useful," load. The 15 per cent reduction in inflation means a 40 per cent reduction in the entire load, as well as 40 per cent less than what an 85-per-cent-full hydrogen ship could lift.

Helium is safe and the *Shenandoah* has demonstrated that it is practicable. Its cost is the principal argument against its use. A single minute's valving to descend may lose from $2,000 to $3,500 worth of the precious gas.

THE START UP THE PACIFIC COAST

The weather was raw and hazy, with head winds down the coast, when the *Shenandoah* cast off from the San Diego mast at 9:15 a. m., October 16. Fifteen minutes later she had rounded Point Loma and was headed northward, over the Pacific Ocean, and 5 miles offshore. The battle fleet was at target practice, shots ricocheting across the surface with splashes a mile apart, in San Pedro Channel, off Catalina Island, at 12:15 p. m.

Greetings were exchanged between Ad-

Photograph by Junius B. Wood

THOUSANDS WAITING TO SEE THE AIRSHIP CAST OFF FROM CAMP LEWIS, WASHINGTON

After crossing Tacoma, the *Shenandoah* circled over Seattle and Green Lake. Then the big ship turned back, saw the fish traps in the tip of the Hood Canal, and sailed an hour over the drear Skokomish Indian Reservation, whose virgin forests, cleared circles furrowed by fallen pines, homes, and farms along the streams made a pictorial story of growing civilization from the forest and chase to industry and the farm (see text, page 42).

miral S. S. Robison, commanding the fleet, and Rear Admiral Moffett, the first of such high rank to make a cruise by air.

The *Shenandoah* circled inland over Los Angeles, skirted Hollywood at 1:10, passed over Santa Monica five minutes later, and was again out over the Pacific.

Picturesque Santa Barbara, white surf breaking below, mountains in the distance, and a string of automobiles on the winding road, was on the starboard side at 3:40. Dusk was falling over the lighthouse and white-fringed rocks of Point Conception at 6:07 p. m. Point Arguello was off the bow at 7 p. m. and the course laid out to sea, straight for Point Piedras Blancas, which was turned at 10:55. Point Sur Light was sighted at 1:17 a. m., October 17, and Point Cypress at 1:55.

Farallon Light was to port at 6:15, but San Francisco, 30 miles away, was invisible in the fog. Point Reyes was turned at 7 o'clock, the town of Mendocino at 11:34, and Fort Bragg, with its peaked-roof redwood lumber mills, at 11:55 a. m.

Point Delgada was reached at 1:04 p. m., and Cape Mendocino, a graveyard of ships of the sea, with its bobbing lightship, at 2:50.

When Admiral Moffett had charge of lighthouses a sleepy skipper told his Scandinavian wheelsman to steer straight for that lightship. He obeyed, and the captain was awakened by the crash, as his craft cut the lightship in two.

Thousands of seals, basking on Sugar Loaf Rock, off Cape Mendocino, flopped into the water as we passed.

Dogs, whales, and pelicans seemed the only denizens of earth, water, or air which were not terrified by the ship. Dogs barked, while other live stock ran; a pelican followed the ship's shadow on the surface as if it were a possible fish, while the whales played with it for miles.

Eureka and the Eel River valley were

Photograph by International

THE RETURN FLIGHT OVER SAN FRANCISCO

On the home-coming trip from the north, the *Shenandoah* "crossed Drakes Bay, where Sir Francis refitted his ships, but failed to discover San Francisco harbor, and sailed over the Golden Gate at 3 o'clock. She swung across San Francisco and was over the Pacific again by 3:30" (see text, page 42). Drakes Bay, a few miles to the north of Stow Lake, was discovered in 1579.

near at 4 o'clock, and at 7:35 p. m. Brookings, Oregon, was opposite and the California coast had been left behind. The rising moon was silvering the sky back of the mountains and lights were flashing at the black mouth of the Rogue River at 9:10 p. m., and at 12:30 a. m., October 18, the ship turned inland over Florence, Oregon, up the Siuslaw River valley, turning northward again in the Willamette Valley, about 15 miles north of Eugene, at 1:58 a. m. It passed between Corvallis and Albany at 2:25, over Salem and the lights of the capital at 3:10, Silverton, with two red flares, at 3:15, and was invisible in the fog when the lights of Portland glowed below, at 4:16.

CRUISING TEN HOURS TO SAVE HELIUM

The radio telephone told the ship that it was over the mooring mast at American Lake, a part of Camp Lewis and about 10 miles south of Tacoma, at 8:15 a. m. As far as the eye could see, there was a solid floor of fog, the peaks of Hood, Rainier, and Glacier, of the Cascade Range, like sentries on a 200-mile front, to the east, and the tip of a single smokestack, the second tallest in the world, to the west.

The mooring mast was invisible, and in the sunshine, over the fog, the ship was two tons light. It cruised at 40 miles an hour to keep down, but did not moor to the mast until 6:30 p. m., October 18.

With the enforced time-killing to avoid valving helium, the voyage north against the head winds had taken more than 57 hours. It was the most monotonous leg of the entire cruise. Smoking is tabu on the ship. A dry smoke, plug, or chewing gum is the only consolation. Smoking one cigar for 57 hours, with an inch unconsumed at the end of the trip, is almost a record.

The Sunday sun was late in rising in Tacoma, and it was 12:05 p. m., October 19, before the *Shenandoah* cast off from the Camp Lewis mast on its return voyage. Tacoma was crossed at 12:25 and the ship circled over Seattle from 1:00 to 1:20. Green Lake, at 1:05 p. m., was the farthest north of the voyage or for any airship on this continent. Admiral Moffett was on the hill of the Bremerton navy yard, with the *Mississippi,* which he once commanded, below and the *Shenandoah* above, at 1:35. The fish traps in the tip of the Hood Canal were on the right at 2:20.

A PICTORIAL STORY OF GROWING CIVILIZATION

For the next hour the *Shenandoah* was sailing over the drear Skokomish Indian Reservation, with its virgin forests, its cleared circles furrowed like big chrysanthemums by the fallen pines, little homes springing up and prosperous farms along the streams—a pictorial story of growing civilization from the forest and the chase to industry and the farm.

Hoquiam was passed, at 3:25 p. m., and we turned southward over the Pacific at 3:47.

A detour was made into the mouth of the Columbia River and over Astoria at 4:40 p. m., but the insistent radios from Portland for another visit could not be acceded to. Lieutenant J. B. Anderson, aërologist aboard, forecast another storm for the coast. He always prophesied head winds. There were no pleasant surprises. He always was right. To meet the full force of this storm would bring slower sailing, and Portland might mean a couple of hours' delay.

Cape Lookout was passed at 6:12 and Cape Arago, in a thick fog, at 9:10 p. m. Cape Mendocino Light was sighted at 1:55 a. m., October 20; Punta Gorda at 2:30, Fort Bragg at 4, and after that everything disappeared in the fog. Beneath it could be heard the sirens of steamers, and through the chasms in the solid mantle of white came glimpses of white-capped waves, surf breaking on rocks, and once of a ship rocked by the storm.

SAN DIEGO MAST LOST IN A FOG BANK 1,000 FEET DEEP

At 8:15 the fog had disappeared and the *Shenandoah* was facing a 50-miles-an-hour gale off Point Arena. For an hour the rocks of the point stuck by her side. Bodega Head was reached at 12:30 p. m., and Point Reyes at 1:55. Only 68 miles had been covered in 5 hours and 40 minutes.

With another struggle she rounded the last rocky head, changed course at Duxbury Point at 2:30, crossed Drakes Bay, where Sir Francis refitted his ships, but failed to discover San Francisco harbor, and sailed over the Golden Gate at 3 o'clock. She swung across San Francisco and was out by San Mateo and over the Pacific again at 3:30.

Monterey was passed at 3:58, Point Sur at 7:41, Point Piedras Blancas at 8:50, Point Arguello, where the skeletons of seven destroyers lie, at 10:32, Santa Barbara at 11:45, the fleet anchored off San Pedro at 2 a. m., October 21, and the San Diego mooring mast at 4.

The mast was unseen and unheard under the fog bank, 1,000 feet deep. When the first pink flush of dawn showed the black peaks of Mexico over a snow-white world, the *Shenandoah* was 20 miles south of the border. She doubled back until Table Mountain, in Mexico, was sighted, at 7:30 a. m.

The ship was becoming lighter under the sun and Commander Lansdowne drove her at 50 miles an hour through the fog, cooling the gas in the mist. Canyons, mountains, and valleys of fog were below when she rose again. The compass station on Imperial Beach was giving

Photograph by Junius B. Wood

WHERE SOIL IS FERTILE AND FARMS ARE CLOSE: NEAR RICHMOND, INDIANA

"From the skies the undulating earth seemed covered with carpets in drab and green and rugs of bright colors, cut into squares and strange shapes, and marked with strings of white, which were highways." Chickens and cows are scurrying for cover as the *Shenandoah's* shadow skims over Richmond, in the famous Whitewater Valley, on the Old National Road.

bearings by radio almost every minute, but the one on Point Loma was silent, closed by an economical government. The ship could tell that it was on a line, but without the cross-bearing from another station could not locate the exact point.

At 9:03 the fog started to burn off. Point Loma suddenly jumped into view, seemingly only a few feet under the bridge, at 10 o'clock. The ship landed on the field at 10:55 a. m. and was moored to the mast at 11:40.

Rear Admiral Moffett had left the ship at Camp Lewis. Captain Stanford E. Moses, commander of the air squadron of the battle fleet, and Lieutenant Commander R. D. Kirkpatrick, battle fleet aviation officer, had made the voyages between San Diego and Tacoma. Joe Johnson, the movie operator, made the northbound voyage.

Captain Thomas T. Craven, commander of the San Diego station, came aboard at San Diego. No more passengers could be risked for the trying trip over the mountains.

The *Shenandoah* cast off from San Diego at 11:07 a. m., October 22, headed south toward Tia Juana, circled between the Otay reservoir and the city to warm up and increase her buoyancy, to get an altitude of 6,000 feet before crossing the first cordillera of the Rockies. She was going south of the Salton Sea.

With 18,000 pounds of fuel aboard, she was heavy and her motors were driving full speed, 1,400 revolutions a minute, while her length tilted upward at an angle of 12 degrees in order to stay in the air.

BREASTING AIR WAVES 1,000 FEET HIGH

Machinist S. C. Halliburton, the assistant engineer officer, clambered down on to the "bridge" twice, with shivery suggestions about the possibility of ending the trip on the side of a mountain.

Sailing was bumpy, and the heavy ship was gliding on the swirling air waves in dips which the altimeter showed were

Photograph by Junius B. Wood

MOTORS ROARING OVER COLUMBUS, OHIO

The propeller of the starboard motor is making 1,200 revolutions a minute, which is standard speed. The port forward motor can be partially seen under the ship. The water-recovery apparatus on the *Shenandoah* consists of several tiers of long, light pipes, exposed to the cooling air, so that the superheated steam condenses and fills water tanks. This American invention is installed on three of the motors, recovering from 110 to 122 pounds of water ballast for every 100 pounds of gasoline consumed.

nearly 1,000 feet between trough and crest. It was the same during the next day over Ohio—no roll, but a pronounced tip to decks and runway.

"She's 5,000 pounds heavy and tipped all she can stand, and engines going full speed," Halliburton insisted.

"Do you want to spill fuel?" Commander Lansdowne asked.

Halliburton again referred to the desirability of finishing the trip in more homelike surroundings.

"Not just yet," Lansdowne decided.

GASOLINE TANKS EMPTIED TO KEEP AFLOAT

Cottonwood was below at 12:25 p. m.; Campo, 12:50, Jacumba, where the last emergency water ballast was dropped on the corrugated tin roofs, at 1:00; Coyote, the first city in the Imperial Valley, 1:40; El Centro, with Calexico and Mexicali, in Mexico, seeming only a few feet away, 2:01; Yuma, Arizona, three miles to the south, 3:10; Mohawk, 5:20; Aztec, 5:46; and Gila Bend, 6:55.

More than a mile above sea-level, the gas was cooling rapidly in the heavily loaded ship. Two gasoline tanks were jettisoned of their contents and another was dropped outright farther on.

The night was cool, and even with a ton of ballast gone the motors were forced to drive her at an angle to maintain the altitude. Enid was recognized at 7:30; Maricopa, 7:50; Casa Grande, 8:15; Tucson, 10:00, and the course was changed to the southeast west of Benson at 10:41.

Near Naco, along the border, the faint moon disappeared. The ship slipped over a mountain, picked up the railroad track, and a few minutes later was over a brilliant city nestling in a bowl of the Mule Mountains, with black peaks on three sides. It was Bisbee, and railroad and valley ended.

"She's tilted to 13 degrees and can't

do any more," Halliburton declared, as he clattered through the metal door and down the ladder.

The motors were straining to the limit. If one had missed, she would have dropped on the mountain side, rapidly coming nearer. Another tank of gasoline was dropped and she rose to 7,300 feet, turned over Bisbee and its mountain walls at 12:40 a. m., October 23, and was going so fast when Naco was sighted ten minutes later, that she was in Mexico before she was able to swing around again to the eastward.

RADIO WHISPERS OF TRAGEDY

The danger was passed. Clear sailing was ahead. Hunched over his key and dials in the radio shack, "Mr. Sparks" resumed his interminable experiments; testing, picking up messages here and there and trying to get stations thousands of miles away. Suddenly his heart jumped as the headpieces, clamped to his ears, ticked out the fragment, "—— in the explosion automobile burned. Both dead."

That the 724-pound gasoline tank had hit an automobile when it crashed to the ground and burst into flames flashed through his mind. The catastrophe had happened. No need to alarm the other officers. Frantically he worked at his key to locate the station which had sent the message. It was gone. No answer came. Other stations came in but knew nothing. He persisted, groping through the air. Then out of the clear, after what seemed an age, came another message, "Man arrested here confesses automobile accident."

This time he located the station. It was several hundred miles from the course of the ship. He took off the headpieces and realized he was perspiring. Even up in the chill clouds the cabin seemed stuffy. He opened the door and looked out. Aft the motors were roaring as if alive, 3,000 feet below the earth slept under the moonlight. It seemed like a nightmare from another world.

Douglas was passed at 1:27 a. m.; Rodeo, New Mexico, 2:30; Hachita, 3:47; Hermanas, 4:40; Columbus, of Villa infamy, 5:21; El Paso, Texas, 9:00 (central time); Fabens, 10; Fort Hancock, 10:45; Sierra Blanca, 11:40; Van Horn, 12:45 p. m.; Pecos, 3:14; Odessa, 5:05; Midland, 5:34; Big Spring, 6:26; Colorado, 7:27; Sweetwater, 8:06; Abilene, 8:57; Fort Worth, 1:30 a. m., October 24, and moored to the mast at 2:27.

The fuel ballast lost in the mountains had killed hopes of a non-stop flight across the continent. If the first night had been less cool or the winds more favorable, it might easily have been made, so much influence do heat and wind have on the sailing time of an airship. However, the return was by the rougher northern route.

The Fort Worth mast was left at 10:33 a. m., October 24, with 16,296 pounds of fuel aboard. Dallas was passed at 11:30; Rowlett at noon; Greenville, 12:48 p. m.; Clarksville, 2:55; Morris Ferry, Arkansas, 4:17; Lockesburg, 4:45; Hot Springs, 6:57; Little Rock, 8:17; Newport and the White River, 10:25; Jonesboro, 11:55; the Mississippi at New Madrid, Missouri, 1:46 a. m., October 25; Paducah, Kentucky, 3:39; Evansville, Indiana, 5:17; Columbus, 8:00; Richmond, 9:30; Greenville, Ohio, 9:55; Dayton, 10:38; Springfield, 11:15; Columbus, noon; Zanesville, 1:06 p. m.; Moundsville, West Virginia, 2:30; Waynesburg, Pennsylvania, 4:10; Chambersburg, 6:28; York, 7:25; Chester, 9:00; Philadelphia, 9:40, and Lakehurst, New Jersey, 11:00, landing on the ground facing the hangar at 11:55.

THE "SHENANDOAH" COMES TO REST BESIDE THE "ZR-3"

An hour later the $2,000,000 *Shenandoah* was berthed in the $3,600,000 hangar, at the side of the fat *ZR-3*, a sailing palace compared to the strictly utilitarian American-built airship.

America's first venture in rigid airship building with its American crew had made the longest cruise of any dirigible from a home base, was the first to see the Pacific or the Northwest of the United States, and had proved that mountains are not a barrier to the big ships, and that helium and mooring masts, which the Zeppelin-seasoned builders and navigators scorn, are practicable.

The same storms which the *Shenandoah* rode through on the Pacific had

Photograph by Pacific and Atlantic

THE "SHENANDOAH" AND THE "LOS ANGELES" SIDE BY SIDE IN THE LAKEHURST HANGAR

Though the *Shenandoah* is purely a military type of rigid airship, its transcontinental cruise blazed the way for commercial rigid ships, of which the *Los Angeles* (*ZR-3*) is the forerunner. Though the former is 24 feet longer than the latter, it is smaller in diameter and, therefore, in gas capacity. The Lakehurst hangar is the largest "single room" in the world, and could house three Woolworth buildings, lying safe to side. It represents an outlay of $3,600,000

sent ships on the rocks and others to dry docks for repairs.

THE CREW ON THE HISTORIC TRIP

Structure and engines had stood the test, but the cruise could not have been made without the skill and tireless energy of the officers and crew. The enlisted men, nearly all with the grade of chief petty officer, were: F. J. Tobin, Arlington, Massachusetts; F. E. Masters, Akron, Ohio; C. A. Heckbert, Rockland, Maine; R. B. Boswell, Pensacola, Florida; E. P. Allen, St. Louis; L. E. Allenly, Logan, Ohio; A. E. Carlson, Moscow, Idaho; J. F. McCarthy, Dorchester, Massachusetts; F. L. Peckham, Humboldt, Iowa; J. H. Collier, Oklahoma City, Oklahoma; R. E. Deal, Quincy, Massachusetts; E. B. O'Sullivan, Lowell, Massachusetts; Amos Barton, Kansas City; J. W. Cullinan, Binghamton, New York; W. A. Russell, New York City; C. W. Broom, Atlantic City, New Jersey; L. K. Coleman, Fort Worth; L. W. Owen, Minneapolis; T. Dickerson, Los Angeles; R. Jones, Los Angeles; W. N. Spratley, Philadelphia; C. P. Mazuco, Staten Island, New York; J. F. Moorman, Buffalo, New York; T. A. Knight, Little Rock, Arkansas; August Quernheim, St. Louis; C. S. Solar, Toledo, and J. J. Hahn, Philadelphia.

Masters remained in San Diego, recovering from an operation for appendicitis, and Broom returned with a broken wrist from cranking his engine in Fort Worth. Cuts and ills of the others were salved by the iodine and salts of the musette-bag medicine chest.

Eleven of the men were riggers—six wheelsmen and five in the keel; fifteen were machinists—twelve on the motors and generator and three in the keel—and Hahn was the cook, the only flying cook in the Navy. When he stepped on a nail in San Diego, 300 volunteered for the place, but he recovered. He worked 22 hours a day, heating coffee, soup, and beans, carrying it up the little ladder, and serving 4,175 superannuated sandwiches and 2,300 cakes of chocolate during the cruise, each with a double shuffle and flourish worthy of a French chef.

"How long ago did we pass San Francisco?" Hahn asked that blustery morning when everybody aboard had about given up hope of ever seeing San Francisco, so absorbed was he in his cooking.

The digest of the cruise, giving the time in hours and minutes, shows:

From Lakehurst	In flight.	In air.	Moored.
To Fort Worth	36:45	38:05	10:41
To San Diego	39:14	41:14	128:15
To Camp Lewis	47:15	57:55	16:55
To San Diego	39:55	47:35	23:25
To Fort Worth	36:25	37:22	8:06
To Lakehurst	35:27	36:22	-----
Totals	235:01	258:33	187:22

The cruise of the *Shenandoah* was over an uncharted world. Beacons by sea and signs by land have been built through the ages for those who voyage on the surface. A new era of transportation is coming nearer, in which the airship will have a place as a conveyance of peace as well as an instrument of war. Many lessons were learned on the *Shenandoah's* cruise.

The American-built and American-manned airship in that cruise showed that mountains and distances are easily negotiable. It also tested the practicability of the American innovations which have been added to the plans Count von Zeppelin laid down.

The voyage to the North Pole and the exploration of the vast unknown polar regions have been made nearer realization by the *Shenandoah's* venture in the face of a blustering autumn. With the springtime, polar flights may come and the world's most inaccessible region will be within easy reach of man.

The United States now has two great airships, small when compared to those of 5,000,000 and 6,000,000 cubic feet displacement, which are planned, but which have already demonstrated their airworthiness and capability for the rigors of polar exploration.

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THE BEAUTIFUL MAIN GATE TO THE PALACE OF VERSAILLES

This is the entrance from the Place d'Armes, through which most visitors pass. At the right may be seen the Grande Chapelle and three of the enormous statues erected in the reign of Louis Philippe.

THE PALACE OF VERSAILLES, ITS PARK AND THE TRIANONS

By Franklin L. Fisher

AS THE tired and travel-worn visitor arrives at the gates of the Palace of Versailles and passes through under the gilded arms of France, he enters the *Cour d'Honneur* and sees facing him the great equestrian statue of Louis XIV, the *roi soleil,* that august monarch who occupied the throne of France for 72 years.

Guarding the court in impressive grandeur are statues of distinguished statesmen and marshals, like giants of old, and even across the vast expanse of cobblestones stretching in every direction these honored of France appear of heroic size.

At either side and in front rise the impressive walls of "the architectural masterpiece of the most brilliant era of a great nation," later transformed by King Louis Philippe (1833-37) into a museum "to all the glories of France."

This is the first view of the palace as seen by the majority of travelers from other lands, who make of it a goal of artistic pilgrimage, a place of historic curiosity, or merely one of the sights of the country, depending upon the visitor and his cultural interests.

The patrons of art come to see the creations of the architect Mansart, the murals and decorations of Le Brun, the portraits by Mignard, the sculptures of Coysevox, and the landscape gardening of Le Nôtre, whose design of the extensive park has been kept almost intact throughout the vicissitudes of the passing years.

For the students of history the shades of such personages as the "Great King" and his successors, who made this their home and seat of government until the Revolution—Molière, Mesdames de Montespan, de Maintenon, de Pompadour, du Barry, and Queen Marie Antoinette—flit through the scene attired in the costumes of the romantic long ago.

Before the eyes of those blessed with a bit of imagination the grand fêtes, which characterized the royal life of the time and by their extravagance kindled the fires of revolution, are reënacted in all their magnificence.

The intrigues of the court, so frequently appearing in literature and upon the dramatic stage, are brought to mind and the frivolities of the pleasure-mad nobility are once more rehearsed. The concourse is again thronged with a ragged populace brandishing aloft crude weapons and shouting demands for food and for death to their King and "The Austrian."

THE ENTRANCE AN ENDLESS OCEAN OF COBBLES

To the casual tourist this grand entrance is a bit forbidding, and he peradventure views with the apprehension that comes to tired feet the seemingly endless ocean of cobbles under the glare of the sun. He feels in his pocket to make sure that there is at hand the necessary small change to meet the requirements of guides and to purchase the usual stock of postcards which he will laboriously indite to the envious folks at home.

Bulging in his side pocket will be his red-backed guidebook, by which he will presently endeavor to follow the French-English discourse of his mentor. Over his shoulder hangs his kodak, ready for the instant recording of yet another film with which he will later proudly prove these wonders in his native land.

The Grande Chapelle, which attracts instant attention upon arrival within the gates, was designed by Mansart, who obtained some of his ideas for it from the Sainte Chapelle in Paris. Louis XIV, having become devout in his later years, "determined to raise that monument of his piety."

In the hundreds of rooms in the palace it is said that 10,000 persons could be housed, and although the facts of the cost of this magnificent creation can never be accurately known, it has been estimated at $100,000,000, which, considering the period and the methods employed by an absolute monarch, is tremendous, even in these eight-hour days.

Photograph from Franklin L. Fisher

THE PALACE OF VERSAILLES FROM THE PLACE D'ARMES

Great spaces enhance the grandeur of Versailles, and the Place d'Armes, upon which the three wide avenues de Sceaux, de Paris, and de St. Cloud converge, is of vast expanse.

Photograph by Ewing Galloway

THE PALACE FROM THE PARTERRE D'EAU

The mirror pools with their marble curbs and their groups of statuary in bronze are seen at either side. The three windows at each end of the second story are those of the Salons de la Guerre and Paix, between which are the seventeen famous windows of the Galerie des Glaces.

The architecture is of the most eye-filling style and the interior furnishings were the *dernier cri* in luxury. A hundred sculptors are said to have been employed to provide the statuary which decorated the gardens as well as the palace itself, and painters beyond count executed masterpieces to adorn its walls and ceilings.

"The double attraction of art and history gives this palace a rare prestige. There is no princely dwelling in Europe that combines so many glorious and interesting memories in a setting of such perfect beauty."

VERSAILLES THE MODEL FOR THE EX-KAISER'S PALACE

It was Versailles which furnished the model for the palace of Sans Souci at Potsdam and other less widely known German palaces, the Schönbrunn at Vienna, the Wren portion of Hampton Court in England, and many others throughout Europe.

Just as Louis XIV made of Versailles the center of interest of his France by the brilliance of his court, and attracted to it those nobles of his country who might have made more trouble for him had they remained at home, it had been the policy of the Bourbons, initiated by Henry IV, to call to France the artistic industries of other countries. The effect of this policy is to be seen even to-day in the artistic productions of the French.

Flemings and Italians who excelled in the finer arts were induced to make their homes in France and to act as teachers to the artistically inclined. In this manner the royal manufactories of tapestries, carpets, furniture, and porcelain were established and the designs of the foreign masters gradually modified and adapted to produce the French classic style.

Colbert, the great minister of Louis XIV, who was bequeathed to him by Cardinal Mazarin, organized an academy of architecture. There was also an academy of painting and sculpture, and even a French academy at Rome had been established to provide further facilities for the art students to see the masterpieces of the Greeks and the Romans.

This policy of encouragement and royal assistance bore glorious fruit. The Palace of Versailles, in its building and decoration, supplied a wonderful atelier for an early expression on a large scale of the genius developed and trained in this manner.

LOUIS XIV CONCEIVES OF A MASTER PALACE

Versailles was not made in a day; its construction continued throughout the reigns of three successive kings. It may be said to have been the conception of Louis XIV, however, for it was he who had the vision of it almost in its entirety, and much may be accomplished in a reign the length of his.

Perhaps his inspiration grew from envy, for it was his first idea to provide a setting for fêtes which would outshine in magnificence and extravagance those of his embezzling superintendent of finance, Fouquet, who had first employed the master landscape gardener, Le Nôtre, to design his own gardens at Belle Ile, where the King had been entertained soon after he had taken over the reins of power.

With his own hand Louis is said to have drawn roughly the plans for Versailles, following designs submitted by Lemercier and Boyceau, and then to have given orders for their execution to the gardener, Le Nôtre; to the first architect, Le Vau; to the painter, Le Brun, and to the sculptor, Coysevox, all of whom worked under royal supervision and were directed by Colbert.

Pierre de Francine, who was skilled in the construction of waterworks, designed the system by which the numerous fountains and pools are still fed with sparkling water from the great reservoirs of Montbauron and Gobert. He received the title of Commander of the Fountains.

The Keller Brothers, who cast the King's cannons at the Paris arsenal, also cast the bronzes designed by the sculptors after suggestions by the King and Le Brun. In short, the foremost artists of France combined to make of this place "the most beautiful spot in the world."

The Palace of Versailles was built around the hunting lodge of Louis XIII, the walls of which still inclose the Marble Court, while the gardens were cut out from the earlier king's estate.

Much of the ground was low and the

earth of the terraces was brought from afar. The necessary grading and leveling, the construction of the aqueduct, and the building of a road from Paris are said to have been the work of years by "all the King's horses and all the King's men," as the song goes, for 36,000 men and 6,000 horses were employed at the task.

WILLIAM I CROWNED EMPEROR OF GERMANY IN THE HALL OF THE MIRRORS

The most famous room, the *Galerie des Glaces* (Hall of the Mirrors), where the King of Prussia was crowned Emperor of Germany at the end of the Franco-Prussian War, and the Treaty of Versailles was signed in 1919, still retains much of its former magnificence, although its silver furniture was sacrificed to the mint when money troubles afflicted the Grand Monarch.

This room is lighted by 17 great windows overlooking the gardens, opposite which are a corresponding number of imitation arcades filled with 306 beveled Venetian mirrors, whose size and brilliance were wonders of their time.

When lighted by myriads of candles, the gorgeous scenes they reflected challenge description. On the vaulted ceiling of this and the rooms at either end, Le Brun painted a series of pictures illustrating allegorically the triumphs of his master's reign. In them Louis is represented as a Roman Emperor in golden armor. This is still the largest painting in France.

On the same floor are the rooms of greatest interest to the romantically inclined, the *Cabinets de Marie Antoinette.* They are small and consist of a boudoir, two libraries, a salon, bath and dressing room, and are adjacent to the *Grands Appartements de la Reine,* the state suite, the bedroom of which was occupied by the succeeding queens of France. Here were born many princelings, and, following ancient royal etiquette, these births took place in public, so that the people might be certain of the authenticity of their royal family.

The bedroom of the King is behind the center of the Hall of the Mirrors, its windows looking out upon the Marble Court toward the Paris gate. Its marble balcony will be remembered, for it was to this that General Lafayette, of our own Revolutionary fame, escorted Louis XVI to be seen by the mob, and where Marie Antoinette by her bravery changed their cry of "Death to the Austrian" to *"Vive le Roi! Vive la Reine!* Let us take them to Paris!"

It was in this room that Molière served as *valet de chambre tapissier* to Louis XIV, and made the King's bed that he might be near the master and thus obtain His Majesty's permission to stage his comedies at the court.

Below the windows of the Hall of the Mirrors, on the opposite front of the palace, is the terrace of the *Parterre d'Eau,* as the two limpid pools inclosed by marble curbs are called. Each of these natural mirrors is decorated with four recumbent statues in bronze which represent the rivers of France. These are masterpieces of sculpture and among the most important groups of bronzes in Europe. Each figure was made by a different sculptor from designs suggested by Le Brun and approved by the King. They were purposely made too large in proportion, so Louis could see them clearly from his windows.

Pierre de Nolhac, formerly Director of the Versailles Museum, who has written a delightful book on Versailles, says at the beginning of his chapter on the garden: "It was the condensed genius of a whole race that created this formal and orderly miracle of flower beds, sparkling water, and marble; this harmonious geometrical figure, to which the sunlight has lent its own dazzling magic."

Straight down the center of the garden are, in order, the Basin of Latona, the *Tapis Vert,* the Basin of Apollo, and the Grand Canal, while to left and right other fountains, lawns, and flower beds fill the visitor's eyes with their striking beauty and pleasing design. Walks lead in every direction and statuary in marble and bronze peoples the vast spaces, which are otherwise often almost deserted except upon fête days.

THE COLONNADE OF MANSART

Near the Basin of Apollo is a bit of striking architecture which has seemed to many rather out of accord with the general scheme of decoration employed throughout the gardens. This is the

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BLINDMAN'S BUFF AS PLAYED IN THE TIME OF MARIE ANTOINETTE, QUEEN OF LOUIS XVI

Louis XIV created and beautified Versailles to provide an alfresco setting where he might outdo in splendor the fêtes given to the nobility by his superintendent Fouquet. The king himself planned the entertainments, the magnificence of which has ever been famous in court annals. Since the rehabilitation of Versailles, companies of players, dressed in costumes of the period, have often come to reënact the events of *le grand siècle.*

A SCENE AT SUNSET IN THE PARK

The gardens of Versailles fall away on every side from a terrace adorned with ornamental basins, statues, and bronze groups. Westward from the Château extends a long greensward avenue bordered with large trees. Of the great number of objects of art that adorned the spacious parks, but few have survived through the tragic years.

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AMONG THE FLOWERBEDS OF VERSAILLES

"It was the condensed genius of a whole race that created this formal and orderly miracle of flowerbeds, sparkling water and marble; this harmonious geometrical figure, to which the sunlight has lent its own dazzling magic." The formal gardens are essentially the same to-day as when first laid out in 1667-88.

THE RED MARBLE FOUNTAIN IN THE BASSIN DE LATONE

Gilded tortoises, frogs and lizards spout water against a white marble group of the Greek goddess Leto (Latona) with her children, Artemis and Apollo. Statuary is arranged around the enclosure, and a glimpse may be caught of the grassy "Tapis Vert" leading to the Grand Canal in the distance.

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THE CHÂTEAU OF VERSAILLES, FROM THE GARDENS

The stories about the creation of this palace and its gardens almost surpass belief. It is said that 36,000 men and 6,000 horses worked for years in preparing the ground for the gardens and park, in making a road to Paris, and bringing water to the gardens, the soil of which covers innumerable pipes, vaults and aqueducts.

THE ARCHITECTURAL TRIUMPH OF THE "GREAT REIGN"

This palace, designed by Louis XIV as a symbol of his reign and as a monument to his greatness, originated in a hunting lodge built for Louis XIII. When its vast additions were completed, it housed thousands attached to the court. The long façade, toward the gardens, has 375 windows, and overlooks far-flung avenues and enchanting lawns.

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A VISTA IN THE GARDENS OF VERSAILLES

The grand architectural lines of the Château are continued in its gardens, the master plan of Le Nôtre, the famous landscape-gardener. Their grandeur and dignity correspond closely with the magnificence of the Château, and afforded a superb setting for the brilliant court life of Louis XIV.

THE QUEEN'S HOUSE IN THE HAMLET: PETIT TRIANON

In a picturesque group of thatched cottages, built on the banks of an artificial lake, Marie Antoinette, with her friends and children, found pleasure and recreation in watching the simple lives of the rustic households that here carried on real farming as a sort of "performance" for royalty. Sometimes the queen amused herself by making butter and cheese.

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THE BELVEDERE OF THE PETIT TRIANON

On a hill overlooking a lake in the Petit Trianon gardens rises this charming Belvedere. Sculptors and painters vied with each other in decorating it exquisitely for Marie Antoinette. The queen's dairy, in the Hamlet, also had a belvedere called Marlborough's Tower, in allusion to a then popular French song.

THE PARK IN SEPTEMBER

When these stately trees are clothed in glorious colors, the scene from the terrace is compelling in its loveliness. Its tinge of melancholy has inspired poets like Alfred de Musset and Verlaine. Shady walks leading to verdant glades, to groves where fountains play, and distant views of wooded heights, create an unforgettable mind picture.

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THE GROTTO OF APOLLO

The celebrated sculptured group at the entrance to the cave portrays the Sun God, who has come to rest in the dwelling of Tethys, goddess of the sea. Her daughters crowd round to serve him and to offer perfumes. In the hollows of the Grotto, to the right and left, are the horses of Apollo.

THE TEMPLE OF LOVE IN THE GARDENS OF THE PETIT TRIANON

This exquisite cupola supported by a Corinthian colonnade stands on a grassy island and spells Romance. In the center is a replica of Edme Bouchardon's first acclaimed masterpiece of "Cupid Making Himself a Bow Out of the Club of Hercules," the original of which is to be found in the Louvre.

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THE MILL OF MARIE ANTOINETTE: PETIT TRIANON

The Hamlet's simplicity evidences the architectural taste of the period immediately preceding the French Revolution, and is in interesting contrast to the splendors of the Château of Versailles. The queen enjoyed her quiet life here, and little credence can be given to the Hamlet legends which picture the royal family in the rôles of comic-opera shepherds.

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THE PARK OF THE PETIT TRIANON IN AUTUMN

A small palace among these trees was the favorite retreat of Marie Antoinette when the restraints of court life and the bondage of etiquette grew too wearisome. She took delight in laying out the park in English style, and its great stands of trees are ever a delight to the forester.

Colonnade, designed and built by Mansart. It consists of a circular arrangement of marble columns supporting a balustrade. Between the columns are marble basins, where jets of water played, and in the center of the inclosure is Girardon's group of Pluto and Proserpine.

A story hangs upon this Colonnade. The services of Le Nôtre had been borrowed by Pope Clement X to rearrange the gardens of the Vatican, and in his absence the King had ordered Mansart to build the Colonnade. Upon the great gardener's return, Louis is said to have escorted him to the spot and to have insisted upon hearing the latter's opinion of the new edifice.

Said Le Nôtre, "Why, Sire, what can I say? Of a mason you have made a gardener, and he has given you a sample of his trade."

The Grand Canal, the main body of which is nearly a mile in length, has two arms extending to the right and left and forming a cross. The former is called the Bras de Trianon because at its extremity are situated the Trianons, and the other the Bras de la Ménagerie because at its end in earlier times stood the royal menagerie.

On these waters, in the time of Louis XIV, boating was a popular diversion of the court, and parties made up of the flower of the nobility often spent the night slowly cruising about under the stars, serenaded by music from the shore or from other boats.

The King had his own magnificent galley, which was hung with the richest silks and rigged in crimson and gold, as well as a miniature battleship fully armed. Venice contributed its most luxurious gondolas, with Italian gondoliers to propel them, and these boatmen lived with their families along the canal, where some of their houses still remain and retain their old name of "Little Venice."

LIGHTING EFFECTS ARRANGED BY VIGARANI

Vigarani, who arranged the King's fêtes, also devised illuminations for the gardens and magnificent displays of fireworks on important occasions. The last great lighting of the Grand Canal and the Basin of Apollo was upon the marriage of Marie Antoinette to the Dauphin, grandson of Louis XV, who later succeeded his grandfather and became Louis XVI.

In the gardens before the south wing of the palace stands the Orangery, a great conservatory built by Mansart, and around it the parterre designed by Le Nôtre. This was built because of Louis XIV's fondness for orange trees, which he not only used to adorn his gardens, but also employed in the decoration of the palace itself. Orange trees in his time stood in chased silver tubs around the walls of the Hall of the Mirrors.

THE BUILDING OF THE TRIANONS

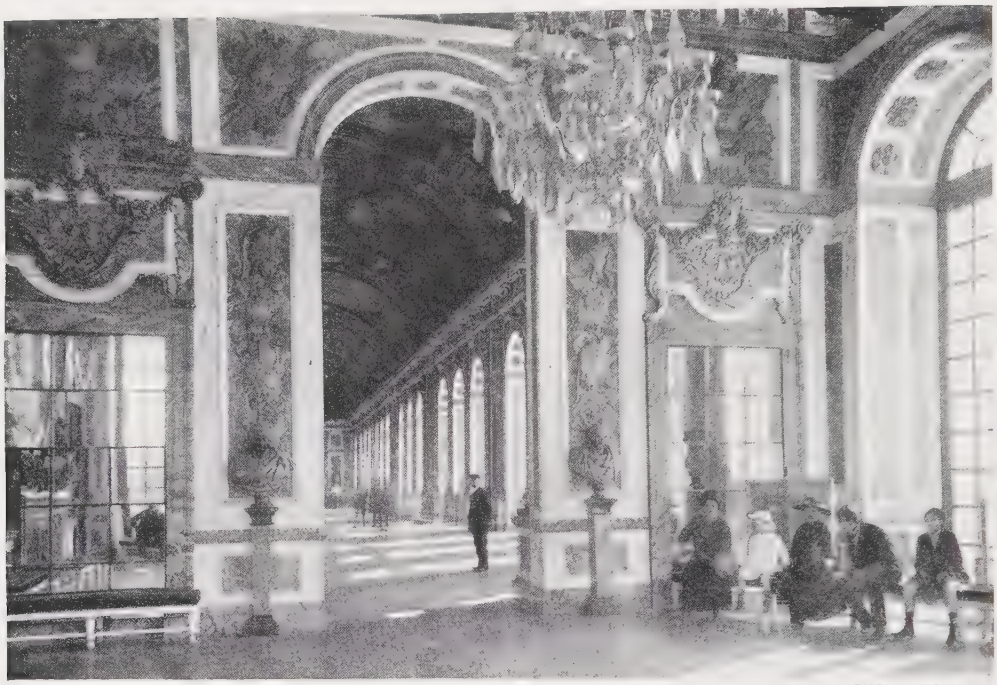
Even before the great palace was completed and the court took up its residence at Versailles, in 1682, the fancy of Madame de Montespan had called for the establishment of a summer house, where fêtes, dancing parties, and suppers could be given. The site chosen was at the end of the right arm of the Grand Canal, where a shabby village called Trianon touched the edge of the park.

The land was taken over, the houses demolished, and the first structure of what is now called the Grand Trianon was built. Later this was rebuilt by Mansart and enlarged.

Madame de Pompadour, Louis XV's most famous mistress, tiring of the attractions of the Grand Trianon, commissioned the architect Gabriel to build a small pavilion near by. In the extended park still another palace was quickly erected, which became known as the Petit Trianon. The interest of the royal family clung to this new palace until the Revolution, and it is perhaps better known than its adjacent predecessor because of its association with the lives of Madame du Barry, who succeeded Madame de Pompadour in the affections of Louis XV, and the ill-fated Marie Antoinette.

Years later the Grand Trianon captivated the fancy of Napoleon Bonaparte, and it was here that he retired for a time after he had his marriage to the Empress Josephine dissolved to permit his grand alliance with Marie Louise of Austria.

Benjamin Franklin, first American en-



Photograph by Clifton Adams

LOOKING INTO THE GALERIE DES GLACES FROM THE SALON DE LA GUERRE

"Kenmore," the historic home of Colonel Fielding Lewis, brother-in-law of George Washington, at Fredericksburg, Virginia, presents an illustration of the far-reaching influence of the decorations at Versailles. In this old house, among the chief things of interest are the ceilings decorated in plaster relief by Hessian prisoners of war from designs by General Washington. They are in the French classic style, and in one room the centerpiece is the conventionalized flaming sun of Louis Quatorze, with nothing less than a portrait of Louis himself in its center.

voy to France, saw Versailles as a private citizen during a visit to Europe in 1767, while Louis XV was still king. Later he visited it officially, when he and his fellow negotiators appeared there in connection with the ratification of the Franco-American alliance signed in 1778.

On his official visit, it is related that he was attired in correct court costume, except that he wore no formal wig, much to the dismay of the attendants charged with the responsibility of enforcing court etiquette down to the minutest detail. A wigmaker had previously endeavored to remedy the omission from his stock of wigs, none of which could be made to fit. "Your wigs are all too small," remarked Dr. Franklin. "Not at all," replied the wigmaker, "Monsieur's head is far too large!"

Marie Antoinette showed special favor to Franklin and enjoyed conversing with him about the new country, in which her interest had been aroused by General Lafayette. The American newspapers of the day rallied him not a little about this intimacy and the *New Hampshire Gazette* printed a story in which he is alleged to have gallantly told her that the little bit of electricity he had stolen from Jove did not compare with that fire she had taken for her eyes.

To tell the whole story of Versailles requires the space of at least one good-sized book, for the place is replete with the interest of art and history in an era of splendor. To the uninformed traveler bored with the sights of Europe, it is outstanding in its magnificence, and to those whose reading has brought even a superficial acquaintance with its wonders, the time spent there is all too short.

CHICHEN ITZÁ, AN ANCIENT AMERICAN MECCA

Recent Excavations in Yucatan Are Bringing to Light the Temples, Palaces, and Pyramids of America's Most Holy Native City

By Sylvanus Griswold Morley

Author of "Excavations at Quirigua, Guatemala," and "The Foremost Intellectual Achievement of Ancient America," in the National Geographic Magazine

ABOUT the time the Western Roman Empire was falling to pieces in the Old World, there took place in the New World an event which was profoundly to affect the history and fortunes of America's most brilliant aboriginal people, namely, the discovery of Yucatan by the Maya, sometime between 471 and 530 A. D.

For perhaps a thousand years prior to this date the Maya had been living in the region now included in the States of Tabasco and Chiapas in Mexico, the Department of Petén in Guatemala, and just along the western frontier of Honduras (see the shaded central zone of the map on page 64).

Here a magnificent civilization had been developed. This region, now overgrown with a dense tropical forest, had been cleared and put under intensive cultivation. Great cities had flourished on every side. Lofty pyramid-temples and splendid palaces of cut stone, spacious plazas and courts filled with elaborately carved monuments of strange yet imposing dignity, market places, terraces, causeways, were to have been counted, not by tens and scores but by hundreds and thousands.

Indeed, it is not improbable that this was one of the most densely populated areas of its size in the world during the first five centuries of the Christian Era, the seat of a mighty American empire.

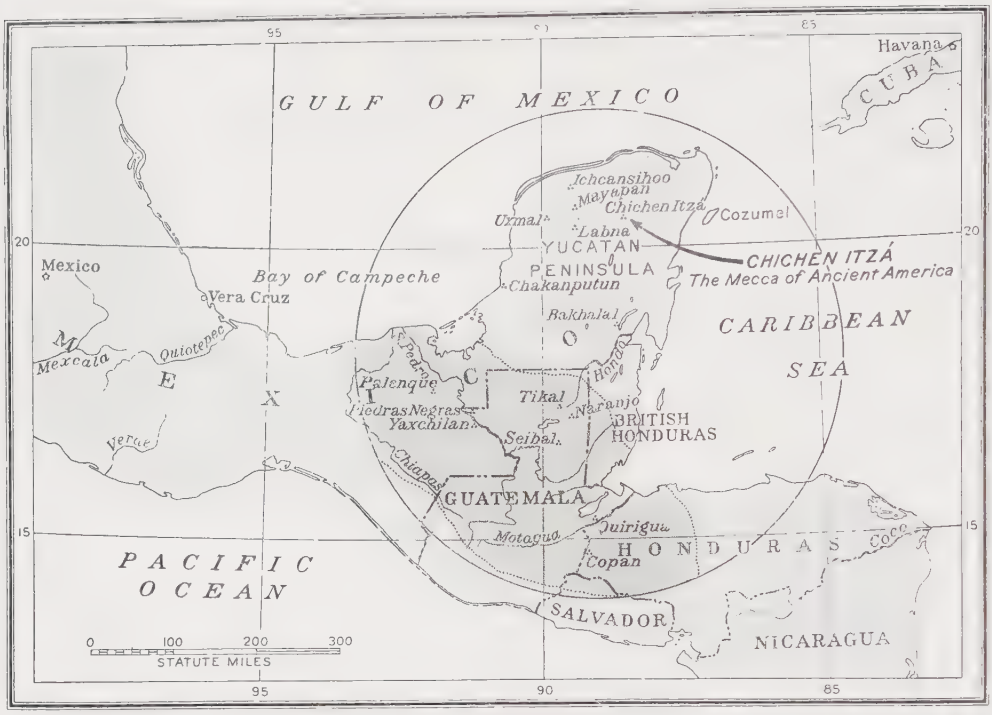
Nor did other arts and sciences lag behind architecture and sculpture in the Mayan cultural procession. Metal, it is true, the Maya of the Old Empire did not have, but the lack of it did not prevent them from carving such a hard substance as jade, which they made into beautiful pectoral plaques sometimes six inches square, showing their principal deities and rulers in acts of adoration or sacrifice.

Necklaces, anklets, wristlets, earrings, nose-ornaments, beads, and pendants were fashioned from the same refractory material, which, even without the aid of metal tools, seems to have presented little difficulty to the Mayan lapidaries.

THE ANCIENT MAYA WERE GREAT MATHEMATICIANS AND ASTRONOMERS

Exquisite wood carvings, delicate modeling in stucco, ceramics, painting, weaving, and gorgeous mosaics made of brilliantly colored feathers were some of the other arts in which, so far as the native races of the New World are concerned, the Old Empire Maya acknowledged few equals and, with the possible exception of the Inca in the art of weaving, no superiors. And when one comes to a knowledge of the abstract sciences, such as arithmetic, chronology, and astronomy, they had few peers among their contemporaries, even in the Old World.

It would carry us too far astray to explore these fascinating fields of ancient Mayan learning, and it must suffice for the present occasion to point out that their system of keeping account of past time—that is, their chronology—was more accurate than anything known in Europe, Asia, or Africa before the time of Pope Gregory XIII, and it is an open question whether Mayan chronology, in the field of



Drawn by James M. Darley

AN OUTLINE MAP OF CENTRAL AMERICA AND SOUTHERN MEXICO

The region within the circle was that occupied by the Mayan civilization during the first fifteen centuries of the Christian Era. The shaded central portion shows where the Maya lived for upward of a thousand years, before the great Mayan Exodus into the Yucatan Peninsula during the fifth to seventh centuries. This is called the Old Empire, while their subsequent history in Yucatan is known as the New Empire. The arrow shows the location of Chichen Itzá, the great American Mecca.

elapsed time, is not more accurate even than our own Gregorian Calendar.

But the Mayan Dark Ages were approaching. Art, architecture, and learning were soon to suffer a temporary eclipse—one, indeed, from which the first never again fully recovered.

THE MAYAN EXODUS PERHAPS DUE TO THE HIGH COST OF LIVING

The Maya during the seventh century were forced to abandon the Old Empire region, where they had wrought so laboriously and had achieved so splendidly, and to seek new homes elsewhere.

The cause, or perhaps better, causes of this great Mayan Exodus are as yet obscure. Climatic changes rendering the region unfit for further habitation, internecine strife, foreign invasions, intellectual and social exhaustion following hard upon such rapid esthetic development, devastating epidemics of yellow fever, even such a modern manifestation as the High Cost of Living, have been suggested to account for this great historic event.

The writer inclines to this last explanation. The agricultural practices in vogue among the ancient Maya were such as gradually to exhaust the productivity of the land available for cultivation. Planting eventually became impossible, as the repeated burnings which alone served to clear the ground in the absence of tools and work animals, permitted such a thick sod to grow that no cereal could force its way up through it.

The people were literally starved into searching for new homes. No lesser calamity than this, it would seem, could have driven a whole nation to such a drastic step as the complete abandonment of a region wherein they had expended such a tremendous effort.

Whatever may have been responsible for this migration, the fact itself is sufficiently

clear, that Yucatan was discovered as early as the latter half of the fifth century, by advance parties of Old Empire Maya pushing northward toward the then, and even still, unexplored forests of southern Yucatan, looking for a new and more promising land in which to found their homes.

CHICHEN ITZÁ WAS FOUNDED AS EARLY AS 530 A. D.

Entrance to the new land was from the south and southeast, somewhere in the region of the present Lake Bakhalal, or as it is more familiarly called Bacalar, and, in the words of one of the old native chronicles, it was while they were at Bacalar, a matter of some sixty years, that "Chichen Itzá was learned about," sometime between 471 and 530 A. D

Yucatan must have held not a few disappointments for these early adventuring Americans. It is at best but a parched and waterless land. There is no surface water, and there are no rivers or streams and only one or two lakes. The country is of limestone formation, with only a subterranean water supply and relatively few places where this may be got at naturally. And these first Mayan explorers had neither time nor means for drilling wells.

Here and there about the country a few natural openings or wells have been formed, great holes in the ground, sometimes several hundred feet in diameter, places where the limestone crust has become undermined and has fallen through, exposing subterranean water. These the Maya called *cenotes,* and wherever they existed, there, by very force of circum-

Photograph from the Carnegie Institution

A MODERN MAYA MAIDEN

The descendants of the Indians who built the great cities of Yucatan in the tenth to fifteenth centuries A. D. still live and labor on the henequen plantations of the same region, the men working in the fields, the women at their household tasks. No cleaner people live than the Maya of Yucatan. It is safe to say that every Maya bathes at least once a day. It is said that the old Spanish law gave every man the right to beat his wife if she did not have a tub of hot water ready for his bath when he came in from work. The young girl in the picture, Theresa, is the daughter of the native foreman at Chichen Itzá. She wears the typical dress of the Maya woman, the *huipil,* a sleeveless garment beautifully embroidered in old-fashioned cross-stitch around the neck and the bottom, and a lace-edged underskirt. Slippers, a colored scarf, and a bow of ribbon for the hair complete the costume. Theresa has embroidered the Spanish word for love, "amor," on her huipil.

Photograph by J. L. Nusbaum

THIS TEMPLE PRESENTS THE OLDEST DATE PRESERVED AT CHICHEN ITZÁ

This small and comparatively inconspicuous temple is one of the most important buildings at Chichen Itzá, from a scientific point of view, since the lintel over its front doorway presents the earliest date yet found in the city. The doorway where this lintel was found does not appear to be the one for which it was originally designed, since the two supporting columns, carved in the likeness of human figures with arms upraised, are so placed that they hide part of the inscription on the under surface of the lintel. It seems probable, therefore, that this slab was originally made to fit a narrower doorway.

stance, important centers of population were established and flourished.

The place where Chichen Itzá was later to be founded was peculiarly favored in this respect, for here the waterless plain of Yucatan is pierced by two of these great natural wells within half a mile of each other. Under primitive conditions, this fact alone determined that an important city would one day grow up around them.

The very name Chichen Itzá has memorialized this fact for all time. *"Chi"* in Maya means mouths, and *"chen"* wells, and Itzá was the name of the particular Mayan tribe or group which had first wandered this way—"The Mouths of the Wells of the Itzá"—a proud and distinctive name, which at once emphasized Itzán importance in the new land as compared with the less fortunate lot of their more "dry" brethren.

Although there is some confusion as to the exact date, the city seems to have been founded not later than 530 A. D.; and here again the "Holy Men of the Itzá," as they are almost worshipfully called in the native chronicles, the Books of Chilan Balam, set up their tribal deities, their Lares and Penates.

CHICHEN ITZÁ AT FIRST UNIMPORTANT IN THE MAYAN WORLD

During the first century of its history, one should not forget that, as cities went in the Mayan world of that day, the new settlement was of little consequence. To a Maya of the late sixth century living in Copan, Tikal, Palenque, or any one of a dozen other cities of the Old Empire, if he gave this little frontier town a thought at all—if, indeed, he had as much as heard of it—he would have dismissed it with precisely the same consideration that the average New Yorker or Bostonian would dismiss the claims of Gallup, New Mexico,

or Deadwood, South Dakota, to metropolitan consideration.

Living in the shadow of the great temples of Copan, let us say, surrounded by all the manifestations of the highest native civilization this continent brought forth, secure in the protection of his gods, rulers, and priests, a Maya of the sixth century might well be pardoned for having looked askance at those more venturesome spirits among his people who, leaving peace and security behind, were pushing outward into such a vast and limitless unknown as the wilderness of Yucatan must have been at that time. He probably would have said: "Let well enough alone. True our fields are no longer as fertile as they used to be, and our crops grow scantier year by year; but even so, why change the surety, the confidence and comforts of life here for the known hardships and unknown terrors of those distant wilds?" Why indeed?

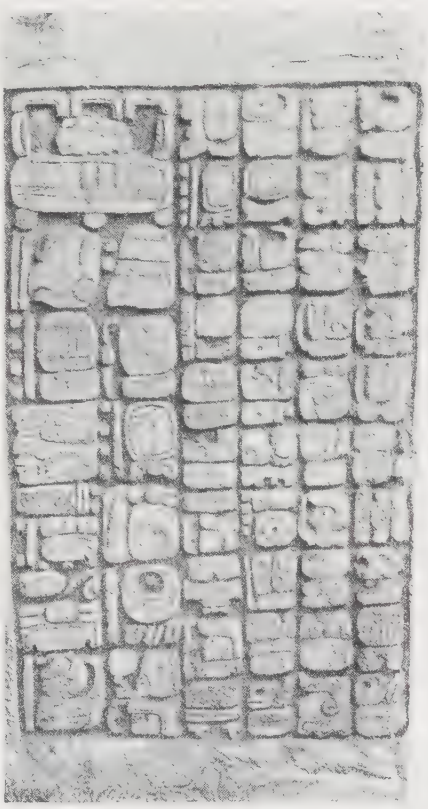
But "mighty oaks from little acorns grow," and the new settlement, founded so inconspicuously as to have caused scarcely a ripple in the Mayan world of that remote day, was destined to outlive them all. In the late New Empire five centuries and more after the cities of the Old Empire had been abandoned and lay in desolation, buried beneath a vast tropical forest, their palaces and temples become the haunt of jaguar and monkey, Chichen Itzá had grown to be the largest city of her day—indeed, more—the holiest city of her times, the Mecca of the Mayan World.

But we are ahead of our story.

THE OLDEST PART OF THE CITY

The city's early struggles must have been acute. It was far removed from other centers of population, and notwithstanding its inexhaustible water supply, it is to be doubted whether the new colony prospered greatly. Only one monument has been found at Chichen Itzá which may surely be ascribed to this first period of its occupation. It is a stone door lintel, which was dedicated on August 28, 619 A. D. It presents no carvings other than its hieroglyphic inscription, but fortunately this is well enough preserved to permit the exact decipherment of its dedicatory date as given on this page.

This lintel was found over the doorway of a small temple in the southern part of the city and its early date, the earliest yet found anywhere at Chichen Itzá, coupled with the fact that the other buildings of this section are in a more advanced state of ruin than elsewhere, suggests that this may be the oldest part of the city.



Photograph by Edward H. Thompson

THE EARLIEST DATED HIEROGLYPHIC INSCRIPTION AT CHICHEN ITZÁ

This inscription is carved upon the front and under side of the principal doorway of the temple shown on the opposite page. The dedicatory date was 10.2.10.0.0 2 Ahau 13 Chen of the Mayan Era, corresponding to August 28, 619, A. D., and is presented on the front of the lintel. The inscription on the under side, shown here, begins with a date 331 days earlier than the dedicatory date, corresponding to October 2, 618 A. D. This latter date (10.2.9.1.9) is expressed by the familiar "bar and dot" numerals already explained in a former issue of the National Geographic Magazine (February, 1922), wherein the bar equals 5 and the dot 1, written in the first two columns to the left.

CHICHEN ITZÁ ABANDONED

In 668 A. D. the city was abandoned for some unknown reason, and the Itzá,

Photograph from the Carnegie Institution

THE CASTILLO, OR GREAT TEMPLE OF KUKULCAN, PATRON DEITY OF CHICHEN ITZÁ

This majestic pyramid, surmounted by an imposing temple, rises in nine receding terraces to a height of 100 feet above the plain and covers an acre of ground. It is approached by four stairways, one on each side, the one ascending the northern face, or front, being flanked by enormous balustrades carved in the likeness of the Feathered Serpent, patron deity of the city, the head resting on the ground at the foot of the stairway, the tail rearing itself aloft on top. The temple proper contains three chambers: an antechamber, or outer corridor, a back corridor extending around on both sides, and the inner sanctuary, the most holy place in the city. It was here that the ceremonies began—the incensing of the sacrificial victims, which terminated so tragically at the brink of the Cenote of Sacrifice, a quarter of a mile distant, at the other end of the Via Sacra (see page 80).

again on the trek, moved westward across the peninsula of Yucatan and founded a new capital, called Chakanputun, in the region south of the modern Campeche, where they dwelt for more than two centuries.

This first abandonment of Chichen Itzá was roughly contemporaneous with the final abandonment of the last surviving cities of the Old Empire—Tikal, Xultun, Uaxactun, Nakum, and others in the northeastern corner of Guatemala—and it may possibly have been due to the same cause, whatever that was, perhaps as already suggested, to the High Cost of Living.

THE CITY REOCCUPIED

The destruction of Chakanputun by fire in 944 A. D. again set the "Holy Men of the Itzá" wandering, and, perhaps mindful of those two cool and refreshing cenotes at the "Mouths of the Wells of the Itzá," like homing pigeons, they turned their steps thither and reoccupied the site in 964 A. D.

But now the horizon of Mayan history broadens. Other tribes, moving out of the Old Empire region into Yucatan, have founded other cities. The Tutul Xiu have established themselves at Uxmal, destined to become the second city in size in the peninsula. The Cocom, a kindred tribe, have built their capital at Mayapan, "The Standard of the Maya" in the northwest, near Uxmal. Many other smaller cities have grown up; at last the New Empire is fairly under way, the second and last phase of the colorful Maya story.

THE LEAGUE OF MAYAPAN, THE MAYAN RENAISSANCE

In 1004 A. D. the three largest city-states—Chichen Itzá, Uxmal, and Mayapan—formed a triple alliance, under the name of the League of Mayapan, by which the government of the peninsula was divided equally among them.

This is the period of the true Mayan Renaissance. Under the peaceful conditions and general prosperity brought about by the league, art and architecture revived. Great buildings of cut stone, elaborately decorated with sculptures, were put up on every side. No town or village was so small and unimportant as not to boast its pyramid-temple and chief's house built of stone. It was in every sense a true Renaissance, and under its quickening influence the Mayan esthetic instinct blossomed forth anew.

Chichen Itzá does not seem to have felt this stimulation as strongly as her sister state, Uxmal, for example, although there are a number of buildings at the Itzán capital which date from this pe-

Photograph by S. Badia

ANTECHAMBER OF THE GREAT TEMPLE OF KUKULCAN

The principal doorway of the temple is flanked by a pair of massive stone columns carved to represent feathered serpents. Looking out through these, one commands a magnificent view of the northern part of the city. To the northeast lies the Group of the Thousand Columns, with its many colonnaded halls, pyramids, temples, courts, and plazas. In front stretches the Via Sacra, leading straight as an arrow from the broad terrace in front of the Castillo to the edge of the Cenote of Sacrifice, a quarter of a mile away (see page 84). To the northwest rise the twin walls of the Great Ball Court, or Tlachtli field, the Temple of the Tigers surmounting the southern end of the eastern wall.

Photograph from the Carnegie Institution

THE STONE RING OF THE TLACHTLI FIELD (SEE ALSO OPPOSITE PAGE)

This great stone ring was formerly fastened to the western wall of the Tlachtli court, opposite the ring shown on page 71. It is 4 feet in diameter, 11 inches in thickness, and the diameter of the hole is 18 inches. Both of these rings are decorated on both sides with pairs of intertwining feathered serpents, which are always portrayed at Chichen Itzá as rattlesnakes.

riod—the Akab'tzib (House of the Dark Writing), the Chichanchob (Red House), the House of the Deer, and parts of the Monjas (Monastery)—in fact, most of the middle section of the city, that part lying south and west of the Group of the Thousand Columns.

But not yet had Chichen Itzá reached her greatest development, her crowning glory as the Holy City of the Maya. This was not to come until another turn in the wheel of fate had brought her under the heel of a foreign conqueror and the Itzán people had been made to feel the gall and bitterness of foreign rulers and a foreign religion.

In 1201 A. D. the political structure of the peninsula was shaken to its foundations and the League of Mayapan violently disrupted by war within itself. In that year Hunnac Ceel, the ruler of Mayapan, made war upon Chac Xib Chac (the Very Red Man), the Itzán ruler, because of "certain banquetings with the ruler of Izamal," according to one of the chronicles (we should, perhaps, read here conspiracies), and by the aid of Toltec-Aztec allies from central Mexico inflicted a crushing defeat upon the Holy Men of the Itzá.

The chronicles do not enlighten us further as to what end overtook the "Very

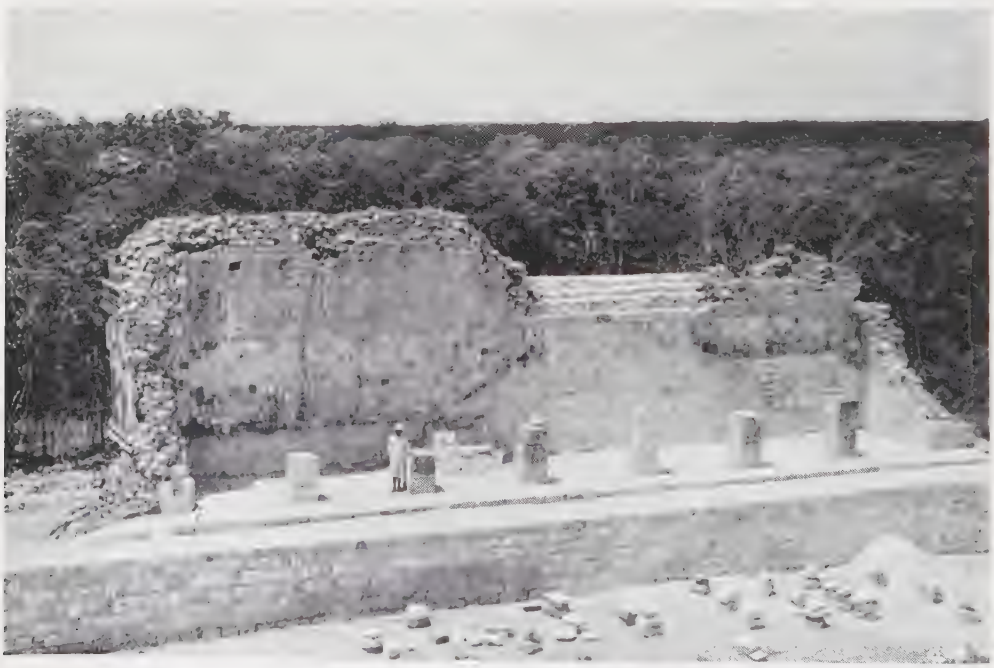
Photograph by J. L. Nusbaum

THE GREAT BALL COURT, OR "TLACHTLI" FIELD

The Tlachtli field, where a game not unlike the modern game of basket-ball was played, is composed of two massive parallel stone walls 119 feet apart, 28 feet high, 39 feet thick at the base, and 272 feet long. At each open end stands a temple (see pages 72-73), and the whole area is as large as a modern football field. In the middle of each wall, 24 feet above the level of the court and directly opposite each other, is a stone ring. The object of the game was to drive a solid rubber ball through this hole, a difficult feat, since the player had to stand close to the wall when he attempted this, otherwise he could not get it through the hole.

STAIRWAY ASCENDING THE WESTERN FACE OF THE CASTILLO

This stairway is 37 feet broad, including its two plain balustrades, and is exceedingly steep, rising at an angle of 45 degrees. There are 103 steps to the summit (see also page 68).



Photographs from the Carnegie Institution

THE SOUTH TEMPLE OF THE TLACHTLI FIELD

This building is 80 feet long and 16 feet wide and was little more than an open portico supported by six square columns. It stands at the southern end of the Tlachtli court, the long, high side walls of which make acoustic properties which are little short of amazing—an ancient whispering gallery.

Photograph from the Carnegie Institution

THE NORTH TEMPLE OF THE TLACHTLI FIELD

This structure is composed of a single chamber, the front supported by two round columns, which, with the three interior walls, are entirely covered with elaborate sculptures portraying lines of marching warriors. The upper part of the back wall slopes forward and acts as a sounding-board, throwing out across the court sounds made in front of it at a position between the two columns. The Tlachtli court constitutes a splendid open-air auditorium capable of accommodating 5,000 people, and upon the occasion of the opening of the state highway from Dzitas, the nearest railroad point to Chichen Itzá, in 1923, beautiful native dances in costume were staged here.

Red Man." Perhaps he fell fighting bravely, as his name might imply, in the defense of his capital. Concerning the fate of the city itself, however, archeology leaves us in little doubt. From this time onward until its final abandonment, in 1448, Chichen Itzá was held in thrall by foreign rulers, the Toltec-Aztec allies of Hunnac Ceel.

This foreign influence from the distant Vale of Anahuac gave to the city not only new rulers, but also new customs, new esthetic inspirations, a new architecture, even a new religion, all of which reacted powerfully upon the Itzá people and raised their capital to a position of honor and sanctity never enjoyed by it or any other Mayan city before or since.

Photograph by Gomez Rul

THE CARACOL, OR ASTRONOMICAL OBSERVATORY

This round tower, rising 75 feet above the plain, is 37 feet in diameter at the base and surmounts a double terrace reached by stairways on the western side. Perhaps the most conspicuous architectural feature is the 5-member cornice running around the top of the lower section. No other building in the whole Mayan area has such a cornice, the usual number being limited to three. There are four doorways facing the four cardinal points, which give access to an outer corridor. Four other doorways pierce the inside wall of this corridor, giving entrance to the inner corridor. These two corridors are circular, running clear around the tower. The center is occupied by a solid core of masonry, in the heart of which is a spiral stairway leading to a small chamber in the upper part. The fancied resemblance of the turning of this stairway to a snail shell has given the name by which the building is now known locally, caracol, meaning snail in Spanish.

This small upper chamber is now almost entirely demolished, but leading off from it, looking due west, is a small stone-lined passage, or line of sight, used for taking astronomical observations upon heavenly bodies at the moment of their setting—the sun, moon, and planets. It is probable that formerly there was a similar line of sight to the east for making sunrise observations, but this has now disappeared with the collapse of the entire eastern side of the tower.

In 1923 Dr. Morley excavated a hieroglyphic monument from a niche between the two stairways ascending the upper terrace, which has 132 hieroglyphics engraved upon it, the longest inscription yet found anywhere in the city.

The conquerors brought with them the worship of the fair golden-haired god, Quetzalcoatl, the "Feathered Serpent." Removed to Chichen Itzá, this Toltec Zeus became Kukulcan, a direct Mayan translation of Quetzalcoatl; and presently

Photograph from the Carnegie Institution

ENTRANCE TO THE TEMPLE OF THE JAGUARS

This structure surmounts the southern end of the eastern wall of the Tlachtli court. It is guarded by two immense feathered-serpent columns, the heads of which, breast high, show here. Note the great round poison fangs in the nearer head, the feathered lips, the curl at the back of the mouth. The hollow, deep-set eyes were formerly filled with an inlay of some sort—shell, obsidian, or colored stones.

all over the northern part of the city, which dates principally from this last period, temples and sanctuaries were rising to the new god, all adorned with highly realistic representations of the Feathered Serpent—in columns, balustrades, cornices, and bas-reliefs—until his sinuous trail was to be seen on every side.

Never before had the city experienced such a building boom. The so-called Castillo, which in fact is not a castle at all, but the principal temple of Kukulcan at Chichen Itzá, dates from this period. It covers an acre of ground and towers more than 100 feet above the level of the broad plaza at its base, overtopping the highest trees. Four balustraded stairways ascend its terraced sides, and the sanctuary on the summit is entered through a doorway flanked by feathered serpent columns (see pp. 68, 69, and 72).

Another enormous construction of the Toltec-Aztec period at Chichen Itzá is the Group of the Thousand Columns, a vast architectural complex inclosing a central plaza containing more than five acres, and composed of pyramid-temples, colonnaded halls, sunken courts, terraces and platforms; and here, too, everywhere may be seen the trail of Kukulcan, the

Photograph by S. Badia

THE COURT OF THE THOUSAND COLUMNS, LOOKING SOUTHWEST FROM THE NORTHEAST INTERIOR CORNER

This great court, enclosing an area of five acres, is the center of the Group of the Thousand Columns, that part of the city now being excavated. The name has been derived from the commonest architectural feature of the group, the round columns. More than a thousand of these have been counted in the different temples, halls, and colonnades surrounding the court. These columns, composed of drum-like sections, averaging just under 2 feet in diameter, are from 8 to 10 feet in height. A few of the halls have square columns instead of round ones; these also are made in sections. Most of the columns are plain, though a few are sculptured with the figures of gods, rulers, and priests. This group dates from the Toltec-Aztec Period at Chichen Itzá and is between five and eight centuries old.

Photograph from the Carnegie Institution

THE TEMPLE OF THE TABLES

Six tables, or altars, supported by small human figures, were found against the back wall of this sanctuary when it was excavated. The picture shows one of these altars still in its original position on the summit at the right. The whole back wall has fallen, leaving the four square columns of the sanctuary exposed. The other five altars are fallen, though the statuettes which originally supported them are scattered about in the immediate vicinity.

Photograph from the Carnegie Institution

STAIRWAY LEADING TO THE EAST WALL OF THE TLACHTLI FIELD

The backs of the two side walls of the Tlachtli court originally were provided with wide stairways ascending to their summits, which afforded a splendid view of the game being played below. The balustrades of these stairways are again representations of the feathered rattlesnake. In the stairway shown above, the rattles are at the bottom of the balustrade and the head, now missing, was at the top. These rattles appear to the left and two steps below the standing figure.

Feathered Serpent, patron deity of the city.

Other buildings of the period are the Tlachtli-ground or Ball Court and the Temple of the Jaguars, the Caracol or Astronomical Observatory, the Temple of the Tables, the High Priest's Grave, the Northwest Group, etc.

In two and a half centuries, 1201-1448 A. D., more buildings went up in the city than had been built since its foundation, six centuries earlier.

The foreign rulers, with their new ideas, their new customs, their new religion, gave to the Itzá just that impetus, just that spur to do, which had been lacking at the end of the twelfth century, almost to the point of stagnation. Under their progressive and vigorous rule, the Itzá came back strongly once again before final eclipse overtook them in the middle of the fifteenth century.

SANCTITY OF THE CITY ASSOCIATED WITH ITS NATURAL WELLS

But nothing has been said as yet regarding the sacred character of Chichen Itzá during this final period, her crowning distinction as the Holy City of the Maya, our justification for calling her an ancient American Mecca.

This claim to special sanctity is so intimately connected with the two cenotes, which had been chiefly, if not solely, responsible for the location of a settlement here in the beginning (see text, page 66), that a description of them may not be out of place.

From the beginning, it is probable that the southern cenote, that known locally as Xtoloc, or "iguana" in Maya, had been used as the chief source of the water supply. It is nearer the center of the city and its sides are less precipitous than those of the northern cenote, so that a masonry stairway could be built down one side leading to the water's edge, 70 feet below the level of the ground.

FEATHERED-SERPENT STAIRWAY LEADING TO THE HIGH PRIEST'S GRAVE

Photographs from the Carnegie Institution

ENTRANCE TO THE BURIAL SHAFT IN THE HIGH PRIEST'S GRAVE

In the floor of the sanctuary of the High Priest's Grave, some 15 feet behind the column shown on page 86, is the above opening. This is the entrance to a stone-lined burial shaft which passes down through the center of the pyramid supporting the temple, to the level of the ground, 37 feet below. At the bottom of this shaft six stone steps lead downward into a small natural hollow in the solid limestone, and in the floor of the latter there is a hole giving into a cavern, the floor of which is still 40 feet lower.

Photograph from the Carnegie Institution

THE SANCTUARY OF THE TEMPLE OF THE TABLES

The ceiling of the sanctuary was supported by four square columns, all sides of which were covered with elaborate sculptures representing gods, rulers, priests, or warriors. In the foreground stand seven of the statuettes which formerly supported the altars across the back wall. The doorway in the center leads to the antechamber of the temple, the ceiling of which was similarly supported by four square sculptured columns. The fretlike ornament leaning against the back wall, between the first and second columns on the left, and the similar ornament just to the right of the doorway originally stood around the edges of the top of the roof, much like the iron fencing around the mansard roofs of fifty years ago. The long tail-like appendages are the tenons by which they were fastened to the roof.

The other cenote is somewhat larger, being 180 feet in diameter, with vertical or even undercut sides; so that it is to be doubted whether it ever served as a source for water, and may from the first, because of its comparative inaccessibility, have been held in some veneration, if not, indeed, in actual awe (see page 84).

ITZÁN MAIDENS SACRIFICED TO THE GODS

The Toltec-Aztec conquerors, however, appear to have been the first to capitalize successfully the semi-sacred character which it had acquired in the passing centuries. This was done by inaugurating at its brink a gruesome sacrificial rite, which was destined to attract pilgrims thither from all parts of the Mayan world; no less, indeed, than hurling into its gloomy depths the young Itzán maidens to appease the wrath of offended deities.

Along with these human sacrifices all sorts of valuable personal objects were thrown into the pool, which until the present day bears the name of Cenote of Sacrifice. Gold and jade ornaments, beautiful pieces of pottery, carved wood, in fact, everything of highest value found its way thither, there to lie for five centuries or more, until rescued from oblivion by the dredge of an archeologist.

SPECTACULAR SACRIFICE ATTRACTED THOUSANDS

The very spectacularity of this cruel rite—the maidens at the brink of the dark pool, the incensing of the priests, the sides lined with waiting thousands, a push, perchance a startled cry, a splash below, and silence—all combined to arouse a general interest in the ceremony. Pilgrims came from far and near to hurl their personal treasures into the depths.

Photograph by Gomez Rul

STONE ALTAR SUPPORTED BY FOUR STATUETTES

One of the stone altars in the sanctuary of the Temple of the Tables is shown at the right. These altars average 4 feet in length by 2½ feet in width and stand 3 feet high. More than a hundred of the statuettes which were originally used to support them have already been found at Chichen Itzá. In the lower left corner appears the face of one of these statuettes, which may have been dedicated to the four Bacabs, a class of Mayan deities presiding over the four cardinal points.

Pendants and bells of gold have been found here which are known to have been made no nearer than Costa Rica, and pottery of a peculiar type, not unlike cloisonné ware, which could only have come from northwestern Mexico. Such was the fame and appeal of this death by water.

The rulers of the city on their part had spared no efforts to give the ceremony a proper setting. The great Temple of Kukulcan had been located with special reference to this pool of sacrifice—that is, facing it—and connected with it by a stone causeway or *Via Sacra,* a quarter of a mile long, 30 feet broad, and in places built up 25 feet above the level of the plain. Other temples had been erected in the immediate vicinity, including two elaborately decorated dancing platforms, and at the edge of the cenote itself there was a small shrine for the last solemn rites.

The somber natural beauty of this deep pool, with its chalky white sides covered with clinging vines of green, the imposing temples, and other buildings associated with it, the long procession of gorgeously

THE MONJAS, PROBABLY THE PALACE OF THE ITZÁN RULERS

This magnificent edifice, with its several annexes, is 300 feet long, 150 feet wide, and it must have been fully 70 feet high. At least eight different periods of construction or modifications of the original building by later additions have been detected, and many of the sculptured stones used in its decoration, practically everywhere except in the second story, belonged to earlier structures now destroyed. The writer uses the chamber in the eastern end of the second story, shown at the left, as his office and bedroom.

robed priests leading their victims to the brink, the spectacular sacrifice itself—a dramatic hurtling through the air into the dark, silent water below—all combined to affect powerfully the aboriginal mind. Thousands were attracted thither, until by the early fifteenth century Chichen Itzá had become, because of this great ceremony, the most holy city in the New Empire — nay more, the Mecca of the Mayan World.

CARNEGIE INSTITUTION BEGINS TEN YEARS OF EXCAVATION AT THIS SITE

For a decade now the Carnegie Institution of Washington has had under consideration a plan for the intensive study of this ancient American metropolis. Several preliminary expeditions had been sent to the site to ascertain the precise nature of the practical as well as the archeological problems involved, and in June, 1923, a formal plan of study covering a period of not less than 10 years was presented to the Mexican Government.

This plan having been approved by the Dirección de Antropología, which has jurisdiction over all archeological remains in the Republic of Mexico, an agreement was reached under the terms of which the Carnegie Institution was granted the privilege of carrying on archeological investigations at Chichen Itzá for a period of 10 years, beginning January 1, 1924.

Before actual excavations could be undertaken, however, it was essential that an accurate survey be made of the city and a base map prepared, to which all subsequent discoveries could be referred, and during the late winter and early spring of last year, through the courtesy of the United States Geological Survey, one of its engineers, Mr. J. O. Kilmartin, made such a map on a scale of 1 to 200, locating thereupon all the artificial constructions within the area surveyed, nearly

Photograph by Gomez Rul

STAIRWAY LEADING TO THE SECOND STORY OF THE MONJAS

Photograph from the Carnegie Institution

THE BACK OF THE SECOND STORY OF THE MONJAS

An especially pleasing feature of the second story of the Monjas is the sloping upper half of the façade, a very unusual treatment in the New Empire. This feature reached its highest development in the Old Empire at Palenque.

Photograph from the Carnegie Institution

THE CENOTÉ OF SACRIFICE

This natural well or hole in the limestone surface is 180 feet in diameter and 70 feet in depth, to the water's edge. The water in this great pocket is another 70 feet deep and remains at the same level practically the year around. This view is taken from a point directly opposite the end of the Via Sacra, which runs from the terrace in front of the Castillo (see page 68) to the sacred well. The small mound on the far bank, where several figures are standing, appears to have been a shrine in which offerings were made and incense was burned. The spot from which the Itzán maidens were hurled to the depths below, together with the Itzán treasure of gold and jade and their most cherished possessions, may be seen just to the left and a little below the standing figure in white, the masonry of the platform showing below the bank.

Fringed with walls of living green, this somber pool lies sinister and silent at one's feet, its solitude broken only by the cooing dove, the melody of the humming bird, and the music of many songsters, which have nested in the rocky ledges of its perpendicular sides. Standing on this hallowed ground, one pictures those fearsome ceremonies, which culminated here so tragically—the long procession winding down the Sacred Way, fanatical priests leading their garlanded victims amid clouds of incense, the waiting thousands gathered round the edges. One sees again that awful rite: a maiden standing at the brink, a leap, a startled cry, a hurtling swiftly through the air to death below, followed by a shower of jades and jewels, the offerings of the pious.

Photograph from the Carnegie Institution

THE RED HOUSE

This building derives its name from a red band running around the antechamber, to which the three doorways shown in this picture give access. Three doorways in the back wall of the antechamber and opposite to the three exterior doorways give entrance to three small sanctuaries of equal size at the back, a most unusual type of ground plan for Mayan temples. Across the back wall of the antechamber, just above the spring of the arch, there is a band of hieroglyphics, 37 feet in length; but unfortunately these have successfully defied all efforts leading to their decipherment up to the present time. The Red House is said to be the best preserved example of Mayan architecture extant.

Photograph from the Carnegie Institution

PAST AND PRESENT

Two hundred thousand Maya toil for foreign masters to-day in the henequen fields of Yucatan, all memory of their former magnificence gone as completely as if it had never been. Their wants are few and easily filled: simple food—tortillas, black beans, squash, chile—and tobacco; cotton stuff to make the shirts and pantaloons for himself and his son and for the huipils of his wife and daughter; anisette by way of a celebration on feast days, and he is as happy as he can be under masters not wholly of his own blood. But, with such a glorious past, it would seem as though his future might be made of even greater promise than this. With proper educational facilities, with fair agricultural opportunities, with intelligent help over the rough places in the road, he must travel from his own simple past to the complicated world of to-day, and there is every reason to expect that he may again fashion for himself a destiny worthy of his splendid ancestry.

a mile square. The other members of the staff, including the writer, in charge of the Chichen Itzá Project, Mr. E. H. Morris, archeologist in charge of excavations, and Mr. Monroe Amsden, assistant archeologist, reached Chichen Itzá the middle of May and excavations were commenced on May 28.

In the case of such a large archeological site as this, any excavation program that was not strongly concentrated, and specialized in its direction, would, of necessity, dissipate itself without satisfactory results, and the work done be lost in that yet to do.

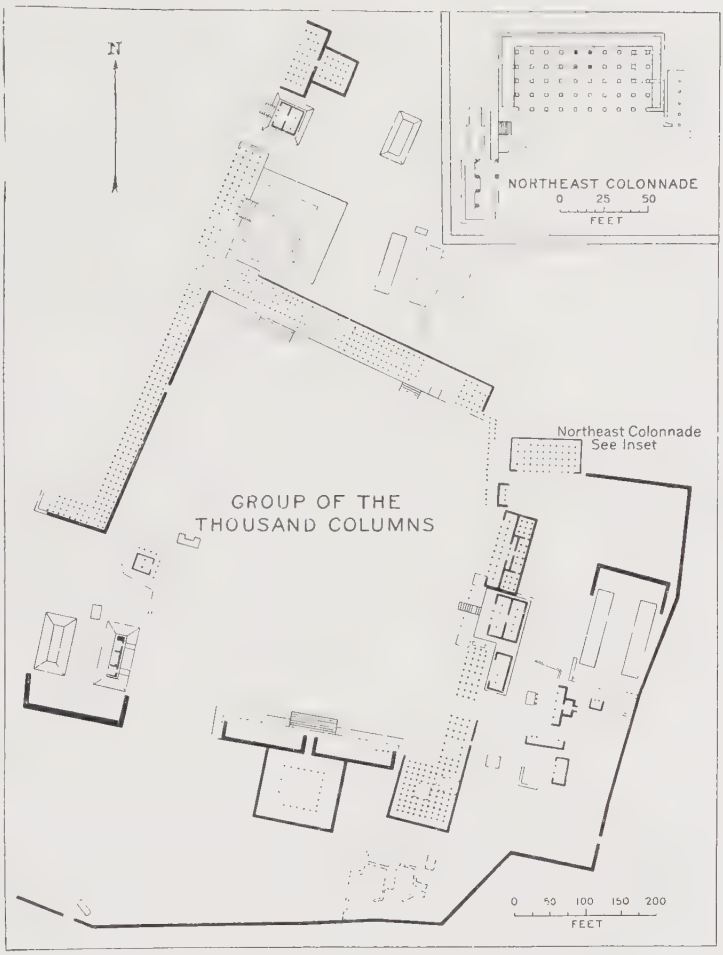
WORK BEGINS IN GROUP OF THE THOUSAND COLUMNS

To this end the city was divided into a number of sections, each section char-

acterized by more or less architectural unity, and that selected as the point at which the excavators should begin their work was the Group of the Thousand Columns, an enormous construction covering, with all of its parts, more than twenty acres (see diagram to the right).

This group was so named because its chief architectural feature is the column, some of which are square, others round; some sculptured and others plain. In the different colonnades, porticos, temples, halls, and minor courts surrounding the great Court of the Columns, the architectural center of the group, more than a thousand different columns have already been counted, ample to justify the name chosen for it.

The Court of the Columns contains five acres of ground. Originally it was paved with a hard lime-plaster, traces of which still are to be found at the edges, though toward the center this pavement has been destroyed by the forest which has everywhere thrown a green mantle over Chichen Itzá, since its final abandonment in the middle of the fifteenth century.



PLAN OF THE GROUP OF THE THOUSAND COLUMNS

The Group of the Thousand Columns covers an area of 20 acres, the great central court around which its several units are arranged containing more than five acres. The group derives its name from the principal architectural feature of this part of the city, the round column, of which more than a thousand have been found in its different temples, colonnades, and halls. The principal excavation made by the Carnegie Institution during the 1924 field season was in the Northeast Colonnade, which was completely cleared of all débris and fallen masonry. An enlarged plan of this edifice appears in the inset at the upper right corner.

The north and west sides of the court are bounded by two very long colonnades of round columns with square capitals, each five columns in depth. The remaining sides are occupied by even more imposing buildings of greater complexity of ground plan, and it was in one of these, the Northeast Colonnade, that excavations were begun in 1924.

CLEARING THE ENTRANCES TO THE COURT OF THE COLUMNS

As a preliminary to this, however, it was thought advisable first to clear out the two principal gateways into the Court of the Columns, so that there might be convenient entrance, without having to climb over the fallen colonnades; and here actual digging was begun on May 28.

Photograph by S. Badia

NORTH GATEWAY TO THE COURT OF THE COLUMNS

The North Gateway to the Court of the Columns passes beneath the colonnade on the north side of this great plaza. It is 66 feet long, 4¾ feet wide at the bottom, with a corbelled roof, and 6½ feet high from the flagstone flooring to the capstone.

Photograph from the Carnegie Institution

SCULPTURAL DETAIL FROM THE NORTH GATEWAY OF THE COURT OF THE COLUMNS

Both ends of the North Gateway were flanked by pairs of handsomely sculptured figures. The one shown above is that of a jaguar (see text, page 89).

The gateway in the western side proved relatively uninteresting. The west colonnade is only two steps higher than the floor level of the Court of the Columns, and this gateway seems to have been a simple passageway between the columns of the colonnade without sculptural embellishment at either end.

The northern gateway proved more interesting. The North Colonnade surmounts a terrace 7 feet above the level of the court, and it is through this terrace, or platform, underneath the colonnade proper, that the northern gateway passes (see page 88). Both ends of this, it was found, had been decorated with flanking sculptured panels; the ones on the eastern sides at each end had jaguars carved upon them, whereas the western jambs were carved with macaws or parrots. Round shields and other jaguar and bird figures completed the sculptural decoration of this gateway, which was paved with well-cut flagstones.

Photograph from the Carnegie Institution

THE SOUTHEAST CORNER OF THE NORTHEAST COLONNADE

The southeastern exterior corner of the Northeast Colonnade was rebuilt above the level of the cornice immediately on top of the sloping base, from the fallen elements of the façade which came out of the excavations at this point. The snake head and flanking rattles, one on each façade at this corner, were restored to their original positions and a few elements of the feathered bodies were added on either side. This work was completed on July 7, the day before President-Elect Calles, of Mexico, visited Chichen Itzá and inspected the excavations.

EXCAVATION OF THE NORTHEAST COLONNADE

The principal work of the 1924 field season was the excavation of the Northeast Colonnade. This building faces south on a small square just east of the Court of the Columns. Directly behind it is a great natural depression several hundred feet in diameter and perhaps 30 feet deep, and its western façade is built against a higher building facing the larger court. This colonnade is 100 feet long, 49 feet wide, and 19½ feet high, rising from a low terrace 2 feet above the level of the square.

The arrangement is simple, dignified, and imposing (for ground-plan, see inset on page 87). It is composed of five tiers of square columns, ten columns in each tier except the front one, where the two end walls (the antæ) occupy the space of

Photograph from the Carnegie Institution

A CORNER OF THE COLONNADE "BEFORE" AND "AFTER" ARCHEOLOGICAL TREATMENT

The picture at the left above shows a mosaic panel after excavation, but before repair had been undertaken, the several motifs present being so badly shifted as to be scarcely identifiable. Beginning at the top, every stone was carefully removed and numbered until a course was reached which appeared to be solid and undisturbed. Next came the more delicate job of repair, and when this was completed the corner appeared as in the picture at the right.

two columns each, making a total of forty-eight for the colonnade.

The eight columns across the front divide the façade into nine doorways. All the columns are made alike—that is, in sections composed of large dressed blocks of limestone—and all are plain save the four central ones at the back, which are elaborately sculptured and inclose a sculptured throne or platform.

FITTING TOGETHER A GIANT JIG-SAW PUZZLE OF STONE

The upper part of the façade was composed of an elaborately sculptured panel, 93 feet long by 11 feet high, a mammoth mosaic of cut stone. The wreck of this latter, scores upon scores of intricately sculptured blocks strewing the terrace in front—feathers, shields, jaguars, macaws, elements of the famous Mayan mask panels, human figures, snake heads, snake tails and bodies scattered about in indescribable confusion—have constituted for the investigators, in their attempts to assemble them, a veritable giant's jig-saw puzzle, the individual pieces of which are heavy blocks of stone.

At each end of this long mosaic, and in the middle as well, there seems to have been a pair of mask panels, one above the other. This element is the most typical decorative motive of the New Mayan Empire. It is composed of two large square eyes, a great curling nose, a mouth with filed teeth, and square earrings. Parts of at least six of these panels have been recovered from the debris in front of the colonnade.

Three round shields, one above the other, came next, and, judging from the large number recovered in the excavations, these must have been a frequently recurring element in the decoration of the façade.

Above the next to last doorway, at each end, there was a human figure fastened to the wall by a tenon at its back. These are gorgeously clothed in featherwork cloaks, panaches of plumes rising

Photograph from the Carnegie Institution

THE RATTLESNAKE AND WARRIOR THRONE

The discovery of this beautiful dais, or throne, against the back wall of the Northeast Colonnade was the high point of the 1924 excavations. This throne is 13¼ feet wide across the front, 7¼ feet deep to the back wall, and 3 feet high. The pair of sculptured columns rise 5 feet above the level of its floor.

from their head-dresses, embroidered girdles, and jade necklaces, pendants, earrings, wristlets and anklets completing the costume. The right hand grasps a spear decorated with tufts of feathers, and the left an embroidered bag.

The building is surmounted by a cornice of the same style as the medial one. These two cornices are themselves extremely decorative. They are composed of three members, the top and bottom ones being plain, the former sloping upward, the latter downward. The middle member, however, is sculptured with a pair of intertwining rattlesnakes, a head and tail with plumed decorations at one end of the cornice and the other head and tail at the other end.

Imagine, then, this façade in its entirety; the nine ample doorways separated by solid square columns, the two rattlesnake cornices, the masks, shields, human, jaguar, and bird figures, this long and elaborately carved panel being painted from one end to the other with a variety of colors—red, blue, green, and yellow—the whole constituting a picture of dazzling and barbaric splendor difficult for the modern eye to visualize, however accustomed it may be to chromatic riot by our own flaming billboards.

A GREAT AUDIENCE HALL OR TRIBUNAL

Passing into the cool shade of the colonnade through the middle doorway and walking toward the back, one passes between the outer pair of sculptured columns, also painted, and stands before a dais or throne, the sides of which are sculptured with lines of warriors, and the cornice with intertwining rattlesnakes running around the top. It is flanked by the inner pair of sculptured columns (see illustration above).

All four sides of these four columns are sculptured, making a total of sixteen panels. Most of the subjects are warriors elaborately clothed in feather-work, embroidered cotton stuff, and jade jewelry, and armed with spears, clubs, and shields. An interesting exception is the front of the back column at the left, which is carved with the representation of Kukulcan, whose likeness is to be seen everywhere in this part of the city. Along the back and side walls run low

Photograph from the Carnegie Institution

THE NORTHEAST COLONNADE FROM THE FRONT

The principal excavations of the 1924 field season were centered here. When digging was begun at this point, on June 2 last, nothing appeared above the level of the ground except the front row of columns, the four back rows being covered to their tops with the fallen masonry of the roof. When excavations were closed, six weeks later, this beautiful example of New Empire architecture had been completely uncovered and partially restored. Including the small addition at the eastern end (see the inset on page 87), the Northeast Colonnade was 150 feet long, 40 feet wide, and 19½ feet high. It is composed of 36 square columns 8 feet high and 2 feet square. In the middle at the back, between a pair of sculptured columns, the justly famous Rattlesnake and Warrior Throne was found, the most important part, the center of interest of the entire colonnade (see page 91).

benches, somewhat lower than the dais just described.

Standing within this large colonnaded hall, with its vaulted roof, now unfortunately fallen, and facing the Rattlesnake and Warrior Throne, one is strongly impressed that this was no temple or sanctuary, but rather an audience chamber, a council hall perhaps, or some tribunal where justice was dispensed.

Mayan temples are of an entirely different type; they are usually composed of a much smaller outer corridor and an inner sanctuary surmounting a more or less lofty pyramid (see pages 68, 72, 73, and 77).

One important feature brought out by the excavations was the several changes which the colonnade had undergone in ancient times. At least two and probably three of these were noted, all of which detracted materially from the original beauty and unity of the design.

The first modification which it suffered was the construction of a small L-shaped portico against its eastern end, the round columns of which are of spindling proportions and crude, rough workmanship. This considerably marred the fine exterior proportions of the original building.

A second modification within the building did equal damage to the interior. At the northeastern corner, secondary walls had been built inclosing six of the columns, making a chamber by itself within the colonnade, but cut off from it, as shown by the ground-plan inset on page 87, where these secondary walls are indicated by dotted lines. This reduced the generous proportions of the original hall.

THE MAYAN ARCHITECTS BUILT POOR ROOFS

A third modification, though one which arose from dire necessity, was to all but destroy the original idea.

There is ample evidence from the 1924 excavations that already, in ancient times, the roofs of these colonnades had begun to weaken and give way beneath the tremendous weight of masonry above them. Mayan roof construction, a series of corbels approaching each other until close enough to be bridged by a capstone, was at best the weakest factor in their buildings; but when such unstable masses of masonry were built upon wooden beams, laid across columns having a 9-foot span, the Mayan masons were courting disaster, which was not slow in overtaking them, even in their own day.

It became necessary before the Northeast Colonnade was finally abandoned to strengthen the roof beams in its northwest corner. This was done by building a stone wall from the level of the floor to the bottom surface of the beams, which were giving way, and no doubt saved the situation for a time (see page 94).

HUMAN STATUETTES USED TO PROP UP A FALLING COLUMN

These sustaining walls are the crudest masonry in the building, and the masons who laid them did not scruple to destroy the sculptured dais itself, in what appears to have been a hasty search for conveniently sized building blocks, since several pieces of the intertwining-serpent cornice of the dais were found in this roughly laid wall.

But the last occupants of the Northeast Colonnade had other structural troubles to worry over beside falling roof beams. It has been explained that this building stands just south of a large, deep, natural depression—indeed, the whole back part of the terrace from which it rises appears to be artificial, having been built up from a considerable distance down the slope.

Even before the building had been abandoned, this fact seems to have caused further structural trouble. The back part of this terrace had begun to settle into the depression, giving rise to an alarming tilting outward of the back tier of columns.

Heroic efforts would again appear to have been made to save the building from destruction. Walls were built between the bench along the back wall and the back columns to keep them from shifting outward, and in one place five Atlantean figures or human-like statuettes, were hurriedly pressed into service to accomplish the same end. These were wedged in tightly—three face downward, one standing on his head, and the other upright—in which position they had served honorably, since the column thus braced had not shifted where they "carried on."

Photograph from the Carnegie Institution

SECONDARY WALL BUILT BETWEEN COLUMNS TO PREVENT THE ROOF FROM FALLING

The Northeast Colonnade began to fall to pieces in ancient times, even before it was abandoned. Particularly the roof beams began to give way beneath the tremendous mass of solid masonry built on top of them. In a frantic effort to save the roof, the last inhabitants of the city built hastily constructed walls of the crudest sort, from the floor to the roof beams, between the columns. The search for stone to put in these supporting walls seems to have been so hasty, indeed, that they did not scruple from laying vandalistic hands upon the Rattlesnake and Warrior Throne and tearing from the cornice some of its sculptured blocks (see illustration, page 91).

The history of this building, which must date from after 1000 A. D.—that is, after the entrance of the Toltec-Aztec influence at Chichen Itzá—is fairly clear from the excavations. The colonnade as originally planned, with its forty-eight columns, is by far the best part of the structure; its building blocks are better dressed and no re-use of elements from other older structures is seen.

Some time after the original colonnade had been completed, a single-room sanctuary was built on top of the high building to the west of it and against which it abuts. In order to reach this, a high stairway was built along the western end of the front of the colonnade, completely hiding it. While this must have seriously impaired the beauty of the building in ancient times, it happily preserved for posterity the only part of the façade above the medial cornice—that part bearing all the sculptured decoration—which has come down to us and has given us not only the original height of the building, 19½ feet, recoverable nowhere else, but also indicated the general arrangement of the several elements of the mosaic—important points indeed (see illustration, page 90).

STRAGGLERS REMAINED AFTER THE CITY WAS ABANDONED

After Chichen Itzá was abandoned, in the middle of the fifteenth century, and the Itzá had withdrawn from Yucatan back toward the south, whence they had originally come, it is highly probable that a few stragglers lingered on in the deserted city and sheltered themselves here and there in its empty temples and palaces.

Some such use appears to have been made of the Northeast Colonnade after the city was generally abandoned, and it is to these last straggling occupants that the hastily constructed walls at the back to prevent the roof beams from falling are due. To their impious hands, forced, perchance, by dire necessity, we may ascribe the violation of the Rattlesnake and Warrior Throne, sculptured frag-

Photograph from the Carnegie Institution

STAFF OF THE CARNEGIE INSTITUTION CHICHEN ITZÁ PROJECT

From left to right: J. O. Kilmartin, engineer United States Geological Survey; Monroe Amsden, assistant archeologist and paymaster; E. H. Morris, archeologist in charge of excavations; Mrs. Morris, and S. G. Morley, Associate of the Institution in charge of the Chichen Itzá Project. The wreck of the expedition's only phonograph, an "archaic" model, strews the table in the foreground, an irreparable loss.

ments of which were found built into these last crude walls (see page 94).

Charcoal, potsherds of crude workmanship scattered here and there about the colonnade, a single jade chisel, tell the tale, eloquently enough, of shoes too large for feet grown suddenly small, a final uncertain occupancy of halls designed for more formal occasions, a last feeble flicker before the light went out.

TEMPLE SITES YIELD FEW ART OBJECTS

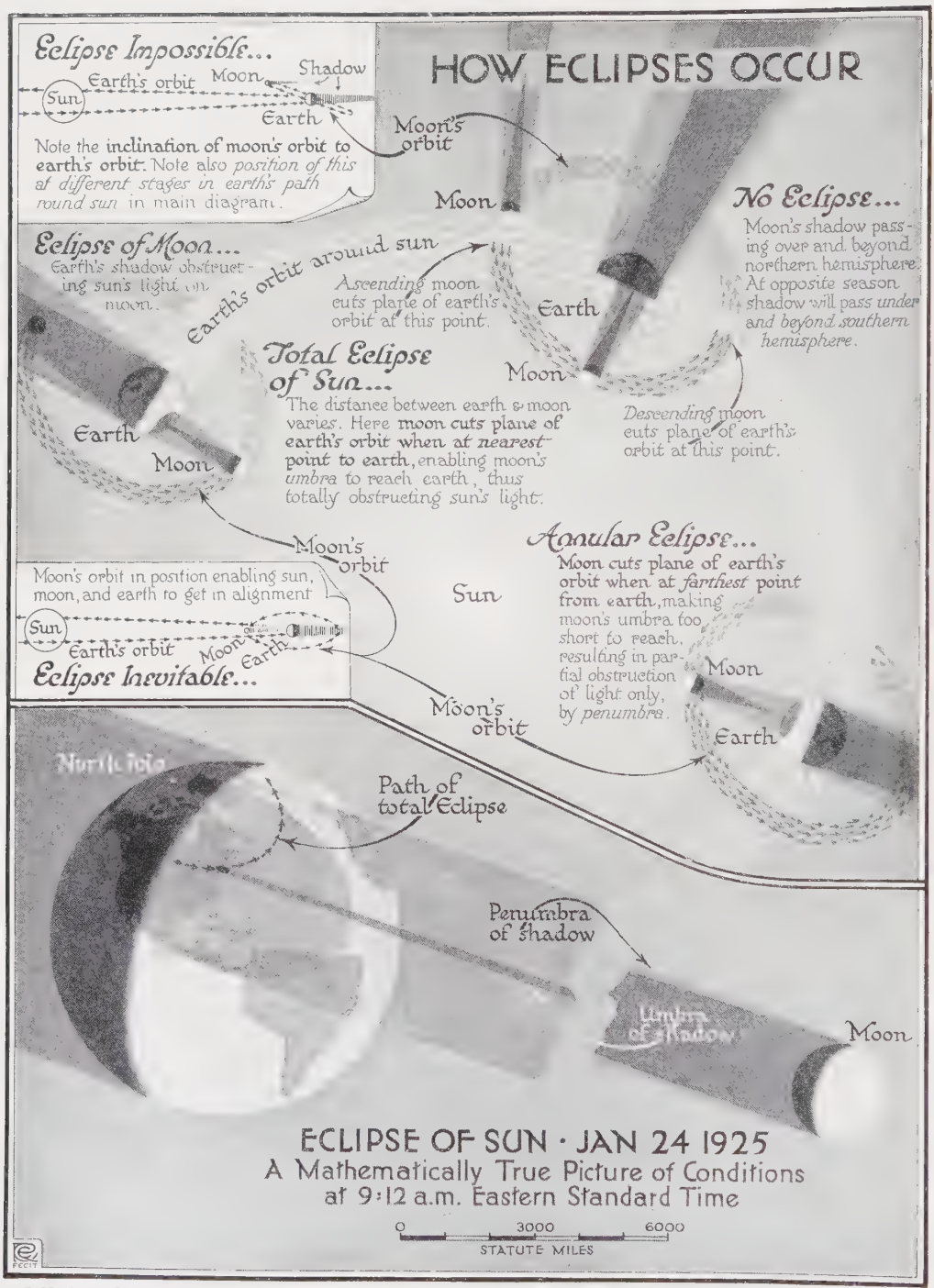
The yield of small objects, ceramics, obsidian knives, jade beads, earrings, etc., was very small, though this had been anticipated. Digging in public buildings is always far less profitable than in tombs and dwelling sites. Temples and palaces were rifled of their treasures before they were abandoned. It is only the homely cooking-pot of clay, the humble corn-grinder, and the polishing-stone that were left behind at the moment of departure, too heavy or too simple to be borne away over long trails to new homes, these and the sacred objects with the dead.

This has been the almost universal experience in American archeology, and it was not to be expected that it would be reversed here. In subsequent seasons tombs will be located, and here the return of smaller objects will undoubtedly be much larger.

The Maya buried their most cherished possessions with the dead, each according to his trade—the huntsman with his favorite spear, the potter with his best-loved bowl, the priest with his books of divination and ritual—and it is certain that part, at least, of this material culture will be recovered as the work proceeds.

To-day how different is the story from that of other times. Silent are the temples, courts, and colonnades; gone the rulers, priests, and sacrificial victims; gone the artisans and builders; gone those humbler folk whose unremitting toil alone made all this pomp and pageantry possible—back to Mother Earth, enshrouded by the living green of tree and bush and flower.

But of a moonlight night, standing on the lofty terrace before the palace of the Itzán kings, the silent city at one's feet, the temples and pyramids rising white and spectral above the dark forest, breezes whispering through the trees bring stirring tales of other days, other men, other deeds, and he who would may listen then and hear.


HOW ECLIPSES OCCUR
Eclipse Impossible...
Earth's orbit
Moon
Shadow
Sun
Earth
Note the inclination of moon's orbit to earth's orbit. Note also position of this at different stages in earth's path round sun in main diagram.
Moon's orbit
Moon
No Eclipse...
Moon's shadow passing over and beyond northern hemisphere. At opposite season shadow will pass under and beyond southern hemisphere.
Eclipse of Moon...
Earth's shadow obstructing sun's light on moon.
Earth's orbit around sun
Ascending moon cuts plane of earth's orbit at this point.
Earth
Total Eclipse of Sun...
The distance between earth & moon varies. Here moon cuts plane of earth's orbit when at nearest point to earth, enabling moon's umbra to reach earth, thus totally obstructing sun's light.
Moon
Descending moon cuts plane of earth's orbit at this point.
Earth
Moon
Moon's orbit
Sun
Annular Eclipse...
Moon cuts plane of earth's orbit when at farthest point from earth, making moon's umbra too short to reach, resulting in partial obstruction of light only, by penumbra.
Moon
Earth
Moon's orbit in position enabling sun, moon, and earth to get in alignment
Sun
Earth's orbit
Moon
Earth
Eclipse Inevitable...
Moon's orbit
Path of total Eclipse
Penumbra of Shadow
Umbra of Shadow
Moon
ECLIPSE OF SUN · JAN 24 1925
A Mathematically True Picture of Conditions at 9:12 a.m. Eastern Standard Time
0
3000
6000
STATUTE MILES

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A PICTORIAL DIAGRAM OF THE CAUSE OF ONE OF THE MOST DRAMATIC SPECTACLES IN NATURE

Those who observe the great celestial performance this month (see text, page 97) will never see it again in the same "theater," for the sun and moon never repeat their "act" along the same circuit within the span of a generation. A clear sky will provide a spectacular event for all beholders along the path of totality. The upper half of the above illustration is diagrammatic and is not drawn to scale.

INTERVIEWING THE STARS

How Twentieth Century Astronomers are Inducing the Heavens to Reveal Their Secrets

By William Joseph Showalter

Author of "Exploring the Glories of the Firmament," "Exploring the Mysteries of Plant Life," etc., etc., in the National Geographic Magazine

ON THE 24th of January the sun and moon are scheduled to stage another of their great periodic dramas in which the Empress of the Night for a few brief minutes banishes the King of Day and rules the diurnal sky.

Only those who have the choice seats directly in front of the center of the stage will be able to get the full benefit of the act. They will be in a strip of territory about 70 miles wide, stretching in a southeasterly direction from a point northwest of Duluth, into the Atlantic Ocean between the upper part of New York city and Newport, Rhode Island.

To the laity the moon will reveal her own utter lack of histrionic abilities; for as she glides between them and the sun they will discover that she is merely a supernumerary, able only to reflect some of the light of her principal on the celestial stage.

But the astronomers who will gather to observe the spectacle will not be interested in the fact that, getting the center of the stage, the moon loses all her borrowed light, and therefore can only be seen as a disk of blackness—an ink spot over the face of the sun.

Rather, they will be interested in the haze of light that appears around the circumference of the lightless moon, for that is the chromosphere of the sun, and it holds many secrets. Also, they will want to see the stars that shine immediately past the edge of the blotted-out sun, for their position may shed new light on the Einstein Theory.

WHAT IS THE GOOD OF IT ALL?

Meanwhile the man in the street will be wanting to know what is the use of such investigations anyway; and if the astronomer takes time to answer, it will be to say, "I don't know."

Nor can anyone foretell what new truths will be discovered, or foresee what new applications to human welfare they may have.

But new scientific knowledge always has a way of turning men's minds to its application to human necessities.

To-day, in peace times, we see the proud American-built *Shenandoah* crossing and recrossing the continent from east to west and from north to south, without fear of the gas explosion which has wrecked so many superb lighter-than-air craft.

And all largely because Lockyer, in 1868, training his spectroscope on the great flames that shoot out from the rim of the sun, detected a new line in their spectrum. He noticed its close resemblance to the lines of hydrogen and concluded it must be the spectroscopic signature of a light gas unknown to terrestrial chemists.

Twenty-eight years passed, with everybody thinking that this gas was a stranger to the earth. Then Sir William Ramsay obtained minute quantities of a new gas from uraninite. Imprisoned in a test tube and electrically excited, it began to glow. Studied with the spectroscope, it showed the same telltale autograph that Lockyer had observed.

A COLLEGE PROFESSOR'S CONTRIBUTION

Later physicists found that when radium disintegrates it produces this same gas, and that it signs itself with the identical superscription that Lockyer found in the light of the terrific eruptions on the rim of the sun and Ramsay discovered in his test tube.

More years passed. The World War was on, and America had entered it. The housewives of the plains of Kansas had been complaining of the quality of their

Photograph from Yerkes Observatory

THE FULL MOON VIEWED THROUGH A TELESCOPE OF MODERATE SIZE

The work of Dr. Charles G. Abbot, of the Astrophysical Observatory of the Smithsonian Institution, in studying the variations of the temperature of the sun and in devising methods of harnessing solar energy to the multiplying needs of our civilization, constitutes one of the classic investigations of astronomy. He has discovered relations between fluctuation of solar temperature and the weather that promise to make long-range weather forecasting possible, and has devised a solar cooker that met all the needs of his household on Mt. Wilson.

natural gas. It didn't make enough heat or sufficient light.

A middle-western university professor, H. P. Cady, was sent down to find the trouble. In his spectroscope appeared once more the unmistakable signature that had come to Lockyer, Ramsay, and to Sir Ernest Rutherford in his manifold investigations of radio-activity.

It told him why that gas wouldn't produce sufficient heat and light—it contained helium, as inert as stone and playing the same rôle in the natural gas that slate plays in coal.

Then the American Chemical Society met. The university professor was put on the program to tell of his discovery. But the war was at its height, and the chemists of the Allied nations were there to discuss how chemistry could help solve

Photograph by the Keystone View Co.

A SERIES OF PHOTOGRAPHS, TAKEN AT SHORT INTERVALS, SHOWING A PARTIAL ECLIPSE OF THE SUN AT SCRANTON, PENNSYLVANIA

In 1900, when numerous expeditions went to Georgia to view the total eclipse, one astronomer, who had followed such events around the earth for more than a third of a century, but had always had to work with his back to the sun in the operation of his instruments, took his wife along. She counted off the seconds, and when there were only five seconds left, he turned to look. His enthusiasm at what he saw probably surpassed that of any other member of any expedition that year. Some astronomers have gone on ten expeditions, traveling over 100,000 miles and getting in less than half an hour's actual observation for the whole series of expeditions.

the paramount concern of the nations in arms—how to win the war.

One chemist after another made his contribution to the discussion. Then came the modest professor. He apologized for intruding a theme upon the attention of that great body which could not, by the longest stretch of his imagination, have any bearing on the momentous issue before which all other matters should stand silent.

But after he spoke a venerable British savant declared that he need offer no apology; that if the war went on another two years the professor's contribution would do more to promote victory than all the other contributions to the proceedings.

Thus came helium as the straw that would break the Hohenzollern back, if all other weights should fail. It made possible the construction of giant dirigibles which could conduct raids over the enemy lines without fear of inflammable bullets.

And it was the training of a spectroscope on a huge flame on the rim of the sun during an eclipse that had first revealed this element.

Romance? Astronomy offers more thrills to the alert human mind than all the fiction in the Library of Congress could provide!

THE TELEPHONE RELEASED FROM WIRE BONDS

The American people listened in on the election returns that gave Mr. Coolidge the tribute of a just servant, and marveled once more at the wonders of radio.

Photograph from Mt. Wilson Observatory

A BIRD'S EYE VIEW OF A LUNAR LANDSCAPE THROUGH THE 100 INCH TELESCOPE

The mountain at the right, near the large poollike crater, is the same height as Mt Wilson The small white splotches at the bottom of the picture are the summits of lunar peaks bathed in the glory of the setting sun. Standing on Mt. Wilson and watching the shadows fall on the slopes of San Jacinto, while its summit still towers into the sunlight, and then, at night, looking through the telescope and seeing the summits of lunar peaks aglow in the same way, is a thrilling experience.

But they little dreamed that a patient Danish astronomer had done the pioneer work which released Bell's telephone from the bondage of wires and made the ether of space its servant.

Yet when Roemer found that eclipses of the moons of Jupiter occurred sixteen minutes earlier when Jupiter and the earth were on the same side of the sun than when on opposite sides, he deduced that light was not instantaneous, but traveled at about 186,000 miles a second.

Clerk Maxwell concluded that light, to travel at such a velocity, must be electromagnetic, and that there must be other wave lengths than those which register on the human eye.

Hertz detected these hypothetical waves, Marconi harnessed them to signaling, and Pupin made them the burden bearers of sound. Vacuum tubes can now take the infinitesimal bit of energy these waves possess after spanning a continent—a bit of energy no greater than a billionth of that expended by a fly in crawling up a windowpane—and, "stepping them up" and amplifying them, make them capable of producing a room-filling sound.

Nor is this the mouth of the majestic stream of consequences that started in the little spring of Roemer's observation of the eclipses of the moons of Jupiter.

The ether waves have been made to reproduce light as well as sound, and radio pictures have hurtled through the air from Washington to Philadelphia.

RADIO MOVIES COMING?

Furthermore, they have been made, experimentally, to carry 16 such pictures a second, which means radio movies. So far has the work progressed that conservative scientists believe the people of the United States, in their own homes and clubs, will be able to "see in" as well as "listen in" on the inauguration of the successor of President Coolidge, in 1929.

Many are the things that astronomy has done for the race, besides leading it away from such narrow beliefs as the doctrine that the earth is the center of the universe, and that the latter revolves around our pigmy globe.

But the man with the telescope, the spectroscope, and other space-sounding instruments still has many problems that challenge him, the solution of any one of which may mean even more to human well-being than the work of Roemer or Lockyer.

For instance, there is the problem of wireless transmission of electric power. As our coal reserves approach a state of exhaustion and our oil wells go dry, a race that is expanding at an unprecedented rate must solve anew the greatest problem of civilization—the problem of power for industry.

In his astronomical dome and his physical laboratory, the astronomer measures the heat of the sun about as accurately as we take the temperature of the water for our morning baths

How much energy does Old Sol send into space? The estimates of Langley and Abbot indicate that if a layer of the best anthracite coal 15 feet thick, covering the entire surface of the sun, could be burned in a single hour, the energy released would not be greater than that which the sun gives off in that length of time.

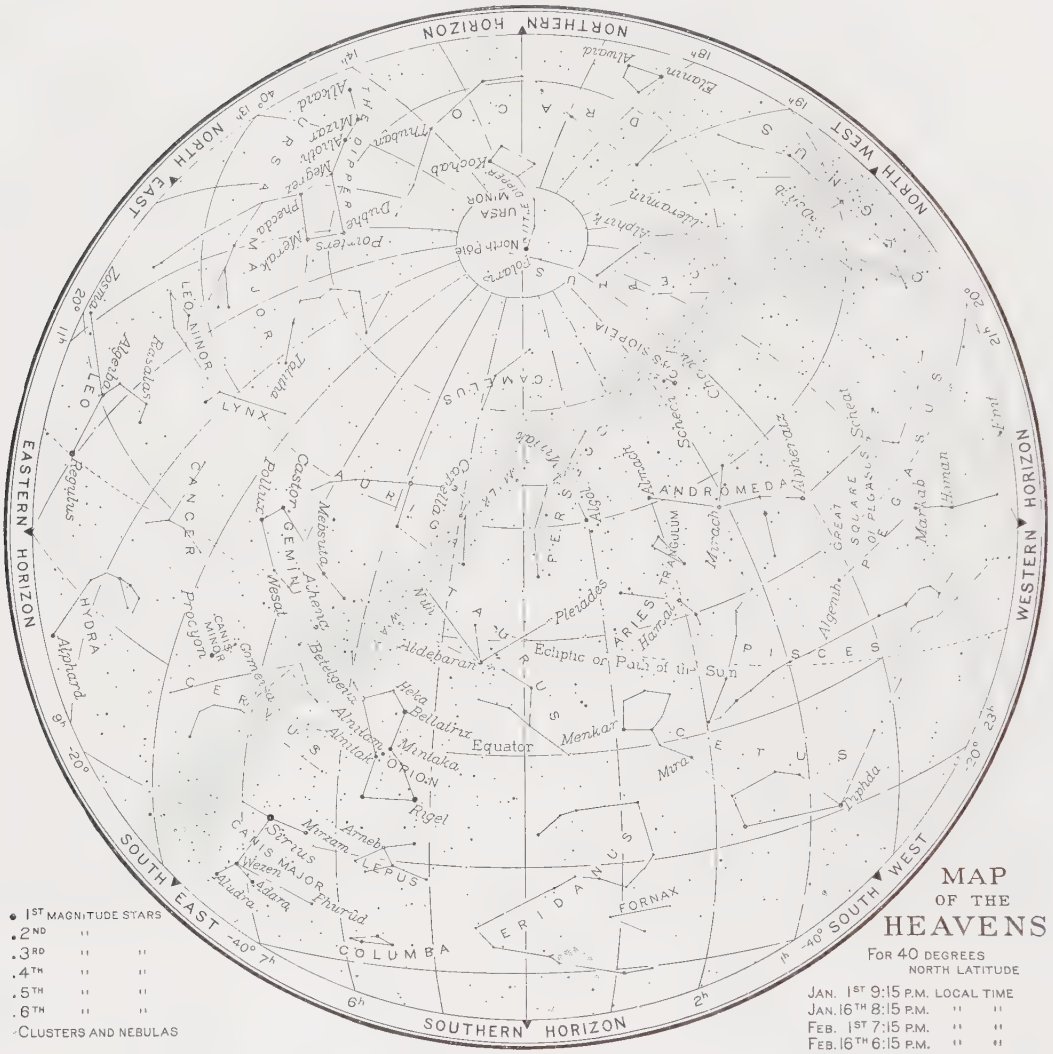
How much of that heat comes to the inhabitants of the earth? Nordmann, in his fine book, "The Kingdom of the Heavens," says 265,000,000 horsepower every 24 hours.

Down through 93,000,000 miles of super-arctic space, where temperatures exist beside which the bitterest cold of the polar regions would seem balmy in comparison, the sun sends us this vast supply of energy, day in and day out.

Some there are who hope the study of the sun may bring lessons that will result in radio power transmission and the utilization of desert sunshine as heat and light and power for the peoples of the fertile plains.

MATTER THAT WEIGHS 25 TONS TO THE PINT

Here is an inkling of a different kind of solution of the problem of power sources after coal and oil supplies are gone. Studying our friend Sirius, the gay Dog Star, and his less brilliant companion, astronomers have found indications that this satellite of the Dog Star has nearly as much mass as the sun, although it is only a little larger than the earth. The evidence is persuasive.



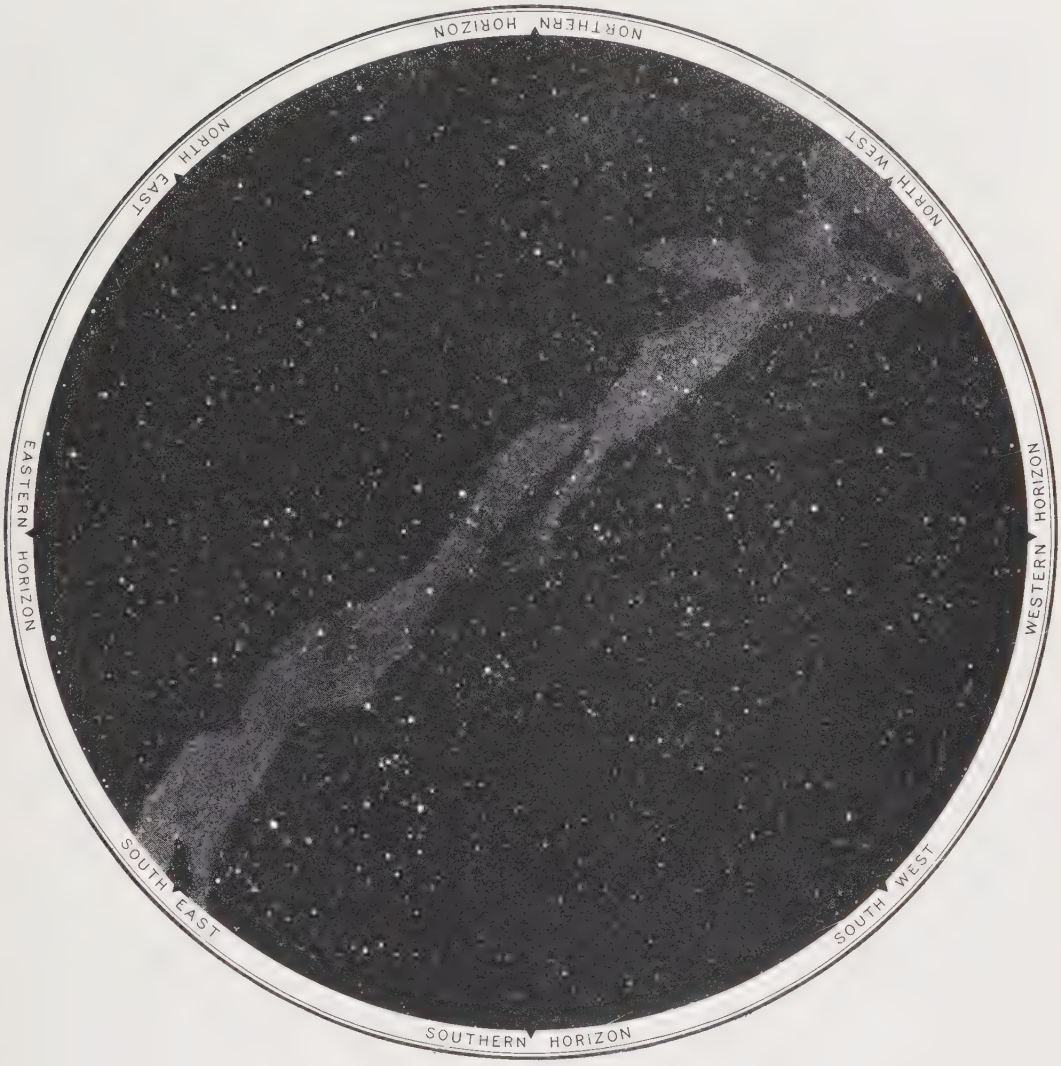
Drawn by Albert H. Bumstead, © National Geographic Society

A CHART OF THE HEAVENS VISIBLE IN THE UNITED STATES AND SOUTHERN CANADA DURING JANUARY AND FEBRUARY

The lines on this chart corresponding to meridians are separated from each other by the distance the stars appear to move across the sky in one hour. The lines corresponding to parallels show the direction of the stars' paths from the time they rise to the time they set. By remembering that the stars within the space bounded by two meridian lines sink into the western horizon every hour, and that a corresponding stretch of new sky rises out of the east in the same time, the major portion of the chart will be usable hours before or after the time indicated in the table at the right. Stars near the North Pole, like the Great Dipper, never set; the daylight merely puts them to sleep. For a corresponding chart of the heavens during the summer months, see page 170 of the August, 1919, GEOGRAPHIC. To get the correct position of the stars, hold the chart overhead, with the horizon marks pointing in their proper direction.

If that be true, then there are states of matter of which man never dreamed before. On that basis this dark star would be 50,000 times as heavy as the same bulk of water. In other words, a pint of the material composing that star would weigh 25 tons.

The world is looking for a good conductor of electricity that will enable industry to transmit power long distances without undue loss of energy. It is possible that this new understanding of the constitution of matter might lead to the open door of a new and better conductor



Drawn by Albert H. Bumstead, © National Geographic Society

A PICTURE MAP OF THE HEAVENS CORRESPONDING TO THE CHART OF THE STARS PRINTED ON THE OPPOSITE PAGE

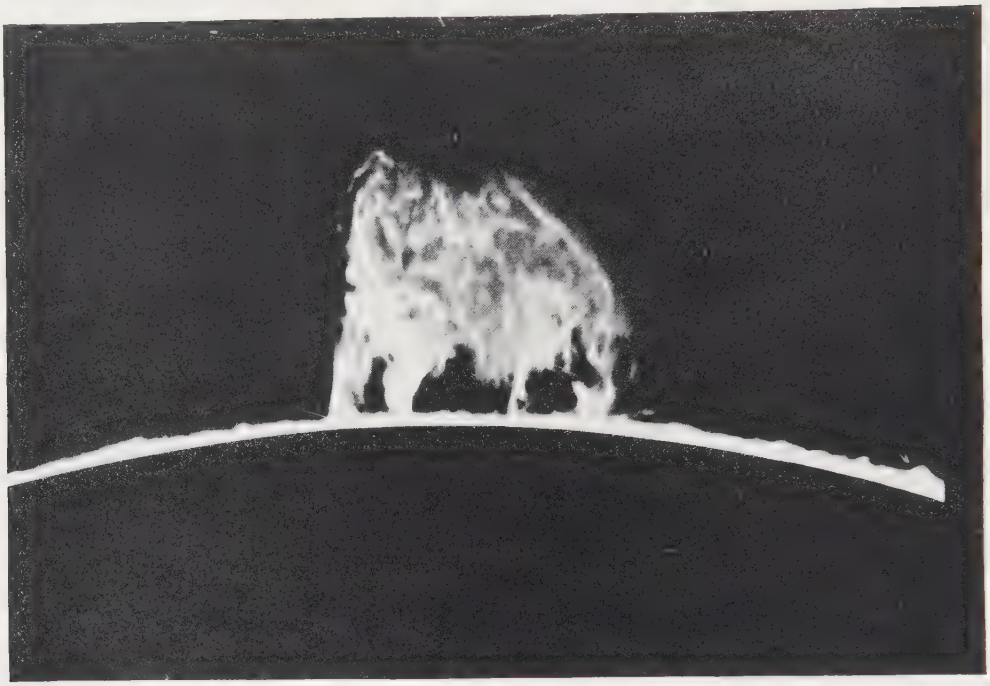
to take the place of the diminishing supply of copper in the transmission of electrical power.

Should such a conductor be found, then the melting snows of the Rockies and the Andes, of the Alps and the Himalayas, might turn the wheels of the world's industries, light the lamps of its homes, and produce all the fires of its kitchen ranges and sitting-room fireplaces.

From the darkened dome that houses his instruments, the night-working astronomer day-dreams of yet other forces that may free the world from the bondage of cold and hunger in the times that far-visioned men discern in the distance.

BREAKING DOWN THE ATOM

If the sun withholds its secret of wireless transmission of power, and if the companion of Sirius refuses to tell how to make denser materials than the earth possesses, there is some basis for the hope that at our own doorstep shall yet be found infinite sources of power that mankind has stumbled over for generations!



Photograph from Yerkes Observatory

"THE WOOLLY ELEPHANT" PROMINENCE ON THE RIM OF THE SUN

The vast eruptions on the surface of the sun send out huge columns of flame that shoot out hundreds of thousands of miles into space at immense velocities. If similar flames poured out from the surface of the earth, they would engulf the moon. Some of these assume bizarre shapes, as in the case of the "Woolly Elephant." Formerly they could be photographed only at times of total eclipse, but the invention of the spectroheliograph makes it possible to photograph them whenever the sun is shining.

The astronomer and the physicist have pooled their forces in cross-examining the atom. In the test tubes of the laboratory and the cosmic crucibles of the skies, they are attacking it with X-rays, spectroscopes, and other instruments of atomic torture, to make it surrender the secret it has withheld from humanity for so long.

When Madame Curie discovered radium and Röntgen produced the X-ray they gave the world an inkling of the unheard-of powers that dwell within these infinitesimal solar systems; and with inconceivably small amounts of this power the physicist is bombarding the atoms to break them up, while the astronomer is studying the forces that affect them in the sun and the fixed stars.

Man has increased his power as he has appealed to smaller units for it or resorted to more complex qualities of these units.

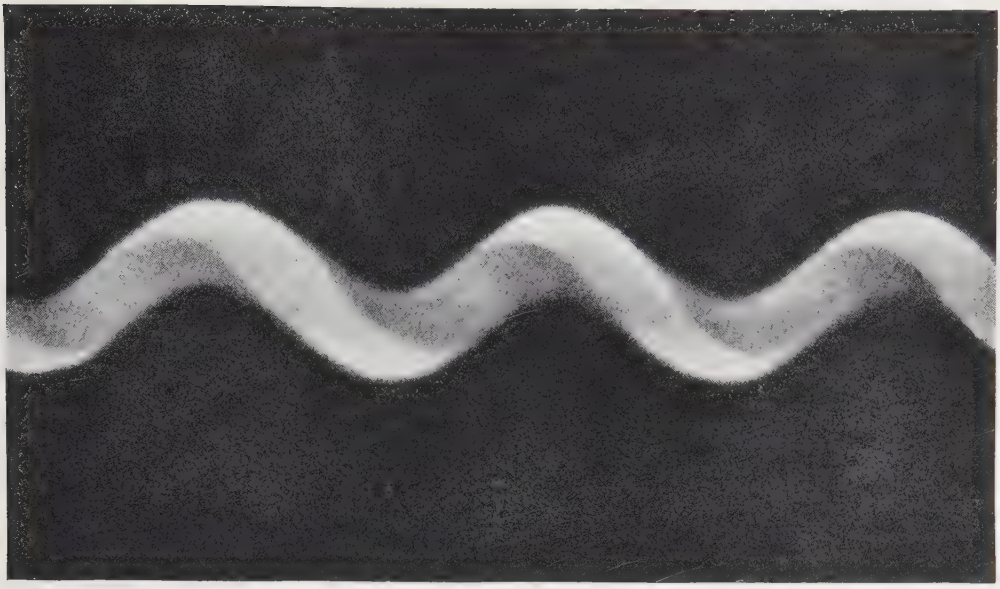
His first use of power, other than that of his own good strength, was a collection of cells—a dog, a horse, an ox.

Then he breasted a stream and faced a wind and built himself a water wheel and a wind engine. Here he was employing the *gravitational* force of molecules, the "lumber" out of which cells are made.

Next he observed the steam raising the lid of a tea-kettle, and straightway began to use the *expansive* force of molecules in the steam engine, greatly multiplying his power.

Observing that when certain substances are mixed together they explode, he began to utilize the *explosive* force of the molecule, which finds its highest use in the modern automobile.

Hints of another force began to trickle through his mind, and *electric* power came into being. We now know that this is a form of atomic excitement, in which streams of electrons shove one another through miles of wire.



Photograph from Mt. Wilson Observatory

A CORKSCREW METEOR TRAIL

When some meteors strike the earth's atmosphere they are of such irregular form that they "wabble" in the air like a poorly rifled high-explosive shell, only much more so.

But the radium atom tells the physicist and the astronomer that atoms explode just as molecules do, only with infinitely more power.

The fastest explosion the Duponts have ever been able to produce has been at the rate of about 7,700 yards a second. The radium atom, in its disintegration, hurls its fragments at the rate of 12,000 miles a second, nearly 3,000 times as fast as the fastest known molecular explosion.

The fall of the water at Niagara represents an energy equivalent to the burning of a ton of coal every second, yet the power slumbering within the atoms of a pitcher of water is as great as that produced by the descent of Niagara's waters for a full day.

GIVING THE ATOM THE "THIRD DEGREE"

Will the physicist, with his superpowered electric furnace, and the astronomer, with his flaming stars, working hand in hand, and often, as in the case of the Mt. Wilson Observatory, as a unit, be able to wrest the atom's secrets from it?

They appear to be pressing it closely. Out at the Pasadena laboratory of the Mt. Wilson Observatory last August, Dr. J. A. Anderson showed me an instrument of atomic inquisition that must, figuratively speaking, twist their tongues and burn the soles of their feet.

It is a great electric condenser, made up of 160 large glass plates, with a capacity of 100,000 volts, and capable of producing, even at 55,000 volts, a momentary discharge of the immense current of 40,000 amperes.

When he turned on the power he invited me to listen to the ghost within. And it certainly sounded like a ghost, pounding and pounding away, as if it were some furious monster in torture, trying to batter down the walls of its prison with a huge mallet. As the current was increased, the pounding became more frenzied.

Then Dr. Anderson laid a wire across the gap of the big transformer and turned on the current again. When the burden became too heavy, there was a flash and a crash, and where the wire had been there was nothing. The metal had exploded, and not a trace of it was left.

That was only a demonstration. When Dr. Anderson really wants to interrogate the atoms, he makes the explosion take place in a high vacuum, preparations for which require a week.

Photograph from Yerkes Observatory

AN ASTRONOMER GOING FROM HIS WORK AT YERKES OBSERVATORY

There is a standing rule that astronomers must stop work in the unheated dome of the big telescope when the thermometer reaches 25° below zero; but if the "seeing" is good the observers break the rule.

Iron, tungsten, lead, aluminum, calcium, and many other materials have been exploded. When they explode they write their record in a specially devised spectograph, which is able to take photographic cognizance of changes occurring in the millionth part of a single second.

THE USES TO WHICH ASTRONOMERS PUT LIGHT

Under such conditions the atoms reveal much of their composition. Those of calcium, for instance, disclose nearly 900 lines in their spectrum.

Watching such an atomic demonstration, one pauses to learn something about the atoms and why they produce all those lines in spectroscope and spectrographs.

These lines serve as probes with which to pry into the behavior and constitution of matter; become speedometers with which to gauge the flight of stars through space; act as thermometers with which to measure the temperature of remote stars; and, in divers other ways, reveal the mysteries of the universe.

Light, after all, is not what it seems to our eyes. While a filament in an electric light bulb appears to be glowing throughout, that is not what is actually happening. That filament is composed of billions of atoms, and each atom is a solar system with a central sun, known as a nucleus, and scores of attendant planets, known as electrons.

The simplest atomic solar system, the hydrogen atom, which has only one planet (electron), will serve better to illustrate what does happen than a complex atom like that of tungsten.

In the hydrogen atom the electron is constantly changing its orbit around its nucleus. Now it has an orbit corresponding, say, to that of the earth; suddenly it jumps the track and flies into another orbit corresponding to that of Mercury; then, perhaps, it hops out to an orbit similar to the orbit of Mars, Jupiter, or even Neptune.

The jumping of the electron from one

orbit to another creates waves in the ether, and the length of the waves depends on the length of the hops. The shortest jumps are apparently most frequent, and the longest most rare.

As the waves engendered by these hops come into the spectroscope, it classifies them, each class making its own particular line.

In this way each line in the spectrum of hydrogen is a summary of all the orbital hops of a given type occurring in the atoms from which the light comes. The frequent jumps make the clear lines and the rare ones give the faint lines.

Heat, magnetism, pressure, and other things affect the orbital behavior of the electrons. In the explosion of calcium with his giant transformer, Dr. Anderson got 800 new lines, showing that its electrons exhibited hundreds of new kinds of orbital behavior under the fierce punishment to which he subjected the calcium atoms.

A PROBE THAT SOLVES THE MYSTERY OF THE COMPOSITION OF STARS

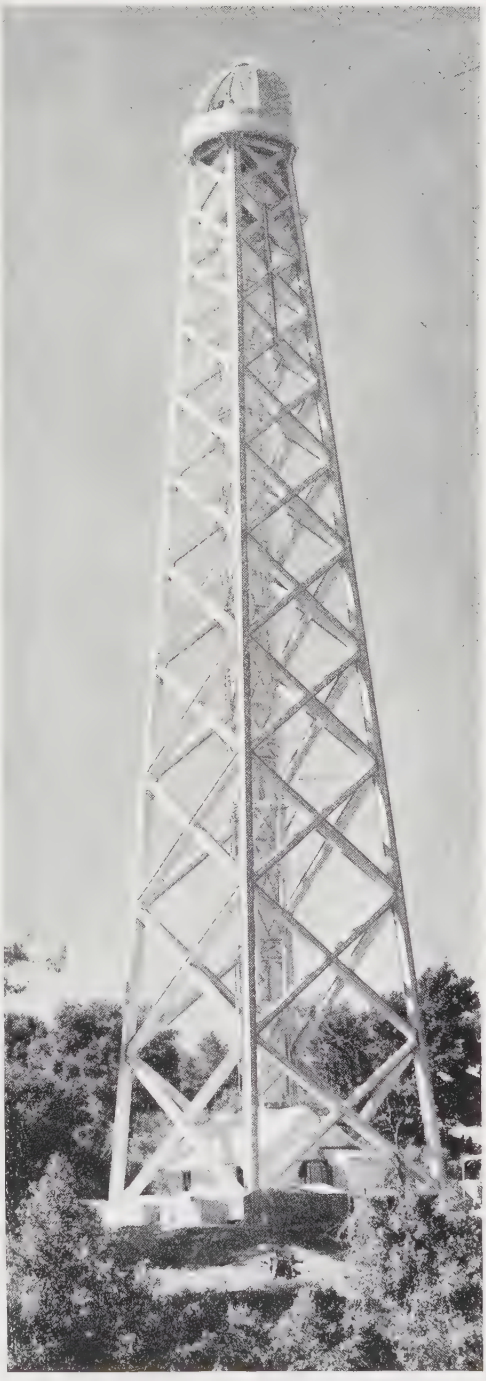
Having seen what causes the lines in the spectroscope, let us see how the astronomer makes use of them in interviewing the stars.

Every element has its own particular group of lines, and no bank cashier or United States Treasurer ever had a signature more certainly his own than each element writes in the spectroscope.

So when an astronomer finds a given set of lines in a star he knows that the element whose signature those lines constitute is found there. When a hitherto-unknown group of lines appears, he knows that a new element has been found, as in the case of helium.

Therefore, hitching his spectroscope to his telescope, the astronomer gets a Brobdingnagian probe with which he can reach out through the vast stretches of space and not only lay bare the materials of which the well-nigh infinitely remote stars and nebulæ are made, but even many of the conditions with which they are surrounded.

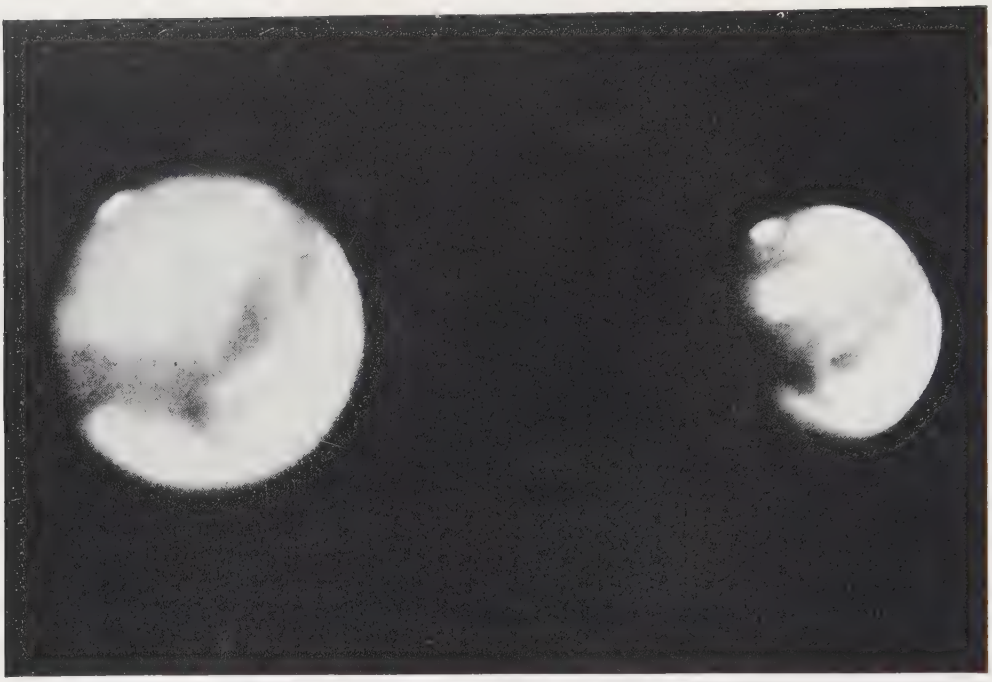
Everyone has noticed in traveling on a double-track railroad and passing a train running in the opposite direction that the pitch of the sound of the bell of the passing locomotive goes from high to low as the train changes from an approaching to



Photograph from Mt. Wilson Observatory

TOWER TELESCOPE USED AT MT. WILSON TO STUDY THE SUN

With this 150-foot tower and a 75-foot well beneath, the sunspots and the great flames, or prominences, on the edge of the sun are made to tell their story.



Photograph from Mt. Wilson Observatory

TWO VIEWS OF MARS SHOWING THE SOUTH POLAR CAP

These pictures, taken at Mt. Wilson a month apart, show different regions of the planet's surface. The polar ice advances in the Martian winter and retreats in summer, as on the earth (see text, page 122).

a receding position. And an expert in acoustics could tell the relative speed of the two trains from the amount of change in pitch; or, knowing the speed of his own train, he could tell the speed of the other.

THE COLOR OF LIGHT BECOMES A SPEEDOMETER

In the same way, when the light from a star moving toward us comes into the spectroscope, the lines in the spectrum crowd toward the end corresponding to the high pitch. When the light from a star moving away is studied, the lines move toward the end corresponding to low pitch. Furthermore, this shift of lines is in proportion to the velocity. Knowing the motion of the earth in space, it is a simple matter to calculate the velocity with which a star under observation is approaching or receding (see page 116).

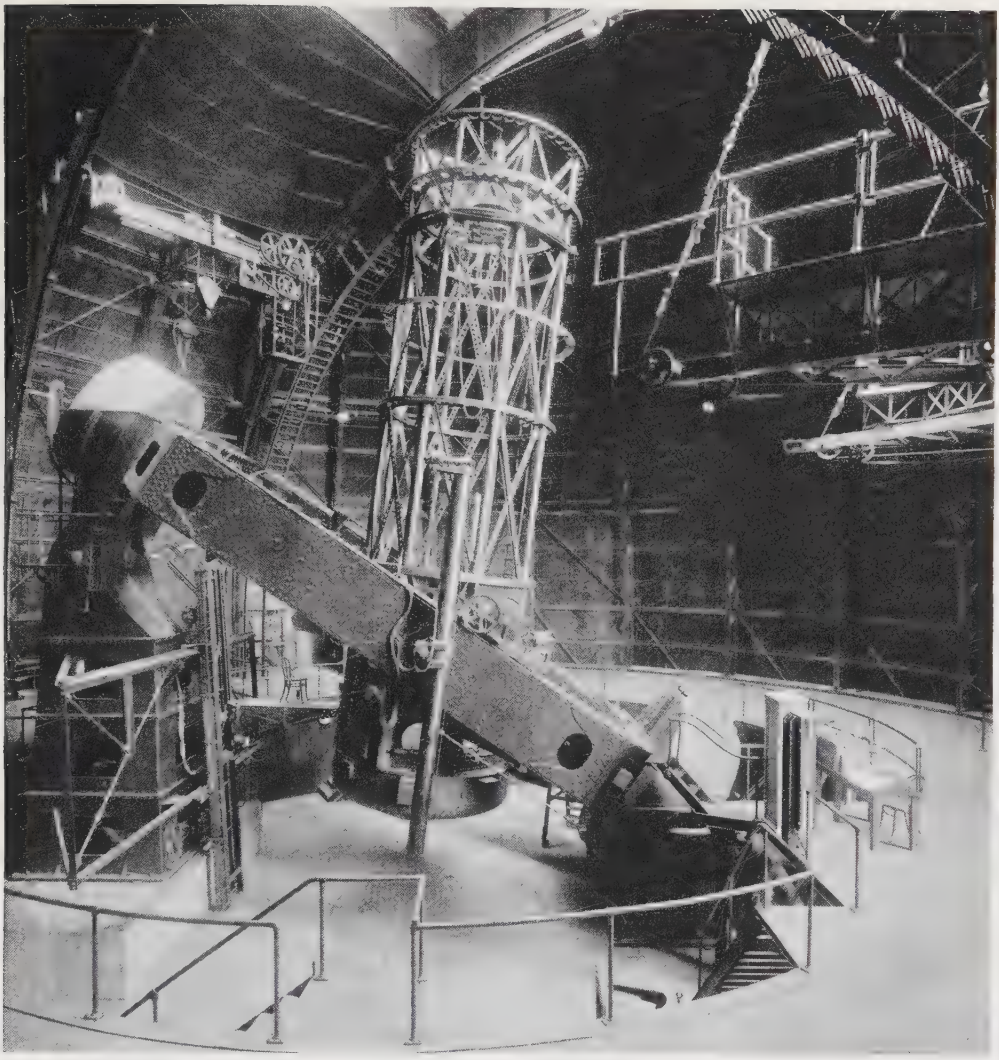
This does not mean that the star is coming head-on or moving straight away at that velocity.

It may, indeed, be traveling almost perpendicular to our line of sight. To illustrate this, suppose one could stand at New Orleans and watch an airplane fly from New York to Los Angeles. When it reaches Dayton, Ohio, it might be flying toward Los Angeles at a speed of 100 miles an hour, but getting closer to New Orleans, by only 10 or 20 miles an hour. The spectroscope could not measure the velocity of the airplane in its actual direction of flight, but only that portion of its motion which brings it closer to New Orleans.

WATCHING AN ASTRONOMER INTERVIEW A SPEED KING

It is a fascinating experience to "sit in" when an astronomer decides to convert his big telescope into a speedometer to measure the velocity with which one of the celestial speed kings is approaching us or retreating.

It may be so far away that, although it is flying across the line of the telescope's sight at the rate of 12,000 miles a minute, the most refined measurements of which the greatest observatory is capable will not reveal that it has moved out of its own tracks in a decade.



Photograph from Mt. Wilson Observatory

THE 100-INCH HOOKER TELESCOPE AT MT. WILSON OBSERVATORY

This reflector telescope has added half a billion stars to human ken. The movable parts weigh 100 tons, but the great instrument can be shifted and its position determined down to infinitesimally small fractions of an inch. The mirror that gathers the starlight and sends it to the eyepiece is at the lower end of the big structural steel barrel. The eyepiece is at the side, and may be placed near the top or bottom, depending on the type of work being done.

But if it is getting "hotter" or "colder," as the children would say in their blindfold games, the spectroscope will measure which, and by how much, in amazing fashion.

One Sunday night I sat with Dr. Sanford in the big Mt. Wilson dome while he and his assistant, with a spectroscope attached to the 100-inch telescope made a number of stars tell whether they were coming closer to us or going farther away.

One star in particular was difficult to interview. The first problem was to get it into the focus of the big telescope. It could not be seen with the naked eye, being so dim that even the 12-inch finding telescope, attached to the big one, could not pick it up.

Searching for it with the big mirror would have been like hunting for a needle in a haystack, for the more powerful a telescope the smaller the area of the

Photograph from Dr. W. W. Campbell

THE CHILE BRANCH OF THE LICK OBSERVATORY, UNIVERSITY OF CALIFORNIA, ON CERRO SAN CRISTOBAL, SANTIAGO, CHILE

The altitude of the observatory above the city of Santiago is 500 feet; above sea level, 2,755 feet. The camera is pointing south-southwest and a part of the city is faintly visible in the notch to the left of the dome. On the summit of the slightly lower peak, in the left foreground, is a heroic and massive statue of the Virgin, to which the people of Chile make pilgrimages in great numbers, especially on feast days. Through two decades this branch of the Lick Observatory has been measuring the motions of approach and recession of the naked-eye stars and of the bright-line nebulæ in the southern two-fifths of the sky. It was the pioneer in this field of research in the Southern Hemisphere.

heavens its field reveals, and a 100-inch instrument sees only a small spot at a time.

FINDING A CELESTIAL TRAVELER

So they found another star, of sufficient magnitude to be seen in the 12-inch finding telescope, that was very close to the one Dr. Sanford was seeking to locate. When the great 100-ton instrument was swung around so as to bring this star on the cross wires of the finder, the pressing of one button here and of another there made slight adjustments in the position of the big instrument until the star to be interviewed as to its observance of the celestial speed laws came into the slit of the spectroscope.

Then the photographic plate was put in. It was no bigger than the palm of a man's hand, and the part of it to be used was much smaller. A button was pressed, an arc light of titanium momentarily appeared, and what is known as the comparison spectrum was photographed on its section of the plate.

Then for two and a half hours we sat there, with an astronomer's eye always glued to the eyepiece.

The top of Mt. Wilson was every moment pointing to a new set of stars, for we were on the rim of the earth, traveling around its axis at the rate of a mile every three and two-fifths seconds to keep our engagement with the morrow's sun on the eastern horizon. But down in a big pier was a huge clock that turned the 100-ton telescope west at the identical rate that the earth's surface moved east, so that it always pointed to that star.

As the minutes rolled by, the temperature would fluctuate a little, the refraction of the air would change slightly, and a few other things that escape every unaided human sense would take place, any one of which would move the star out of its slit in the spectroscope.

But the pressing of one button here and of another there would bring it back. Thus the traffic officers of the observatory quizzed the speed king that was quadrillions of miles away.

When the interview was over, the star had admitted it was "hitting up a pace" that was bringing it 128 miles closer to us every second.

One of the greatest triumphs of modern astronomy has been the discovery, by Dr. Walter S. Adams and his associates at Mt. Wilson Observatory, of spectroscopic methods of fixing the distances of stars. The behavior of electrons in atoms under high pressures and low temperatures and under high temperatures and low pressures causes them to write peculiar lines on the photographic plates of the spectroscope.

Laboratory experiments have revealed the secrets of these lines and the astronomer from their character is able to fix the absolute brightness of almost any star that can register its light in the big telescope. Knowing the absolute brightness and the apparent brightness of a given star, the difference between the two gives the astronomer the data upon which he can compute its distance.

The late Miss Leavitt, of Harvard Observatory, worked out another method of fixing the absolute brightness of certain types of stars in the Small Magellanic Cloud, and her results corroborate the Adams method.

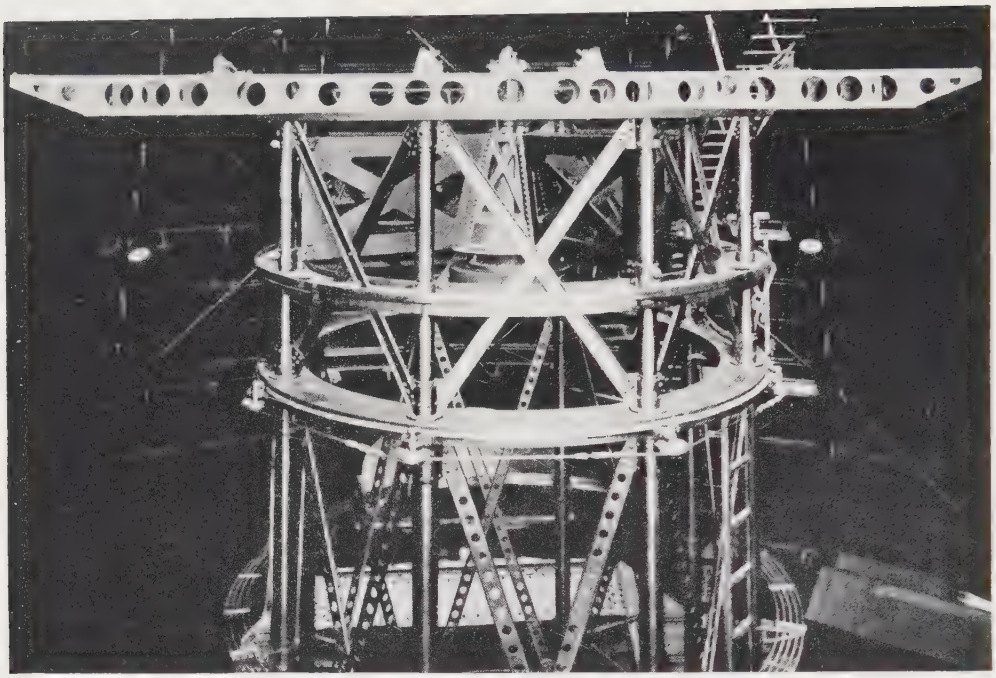
ETHER WAVES TRAVELING ELEVEN MILLION MILES A MINUTE, BRING IMPORTANT NEWS

Long before the first Pharaoh had appeared in Egypt or the Chaldeans or Babylonians had built their first zikkurat, the electrons of a group of atoms in a given star jumped from one orbit to another. In doing so they created a series of ether waves.

These waves swept out into space, hurtling on and on at the tremendous gait of more than eleven million miles a minute, and are just now arriving in the big spectroscope at Mt. Wilson, not only with a message of conditions in the star from which they started at the time they left, but also with a record of the distance they traveled to bring the news.

In fixing stellar distances by the study of spectral lines and light variations, it was necessary to know, by other means, the distances of certain key stars. An explanation of how this has been and is being done is in order.

When a civil engineer wants to find the distance of an inaccessible point, he measures a base line of sufficient length, and from the two ends runs lines with his transit to the point whose distance he wants to determine.



Photograph from Mt. Wilson Observatory

THE 20-FOOT INTERFEROMETER ATTACHED TO THE 100-INCH MT. WILSON TELESCOPE

This is the instrument with which the diameters of Betelgeuse (215,000,000 miles), Arcturus (21,000,000 miles), and Antares (400,000,000 miles) were measured. Two small mirrors on the upper edge and near the ends of the beam gathered the two pencils of light whose "interference" with one another was made to tell the story of the stars' diameters.

Thus he gets a triangle the length of whose base he knows, and the angles the two remaining sides form with the base line. The rest is a high-school problem in mathematics.

In the determination of the distance of the moon, a base line from a given point in America to another given point in France was of sufficient length, and in the measurement of distances of the closer planets the diameter of the earth represented the base line.

But when it comes to finding a base line which will give any appreciable angle in the measurement of star distances, no terrestrial distance will suffice.

GETTING A LINE ON STELLAR NEIGHBORS

After patiently groping for such a base line, the diameter of the earth's orbit was taken. A star was viewed from one side of the orbit and the angle for the one side of the triangle measured. Six months later it was viewed from the other side of the orbit, and the angle for the other line arrived at.

Imagine constructing a triangle with a base one inch long and two sides eight miles long, and then measuring the angles at which the two sides depart from the base!

That was the sort of problem Bessel had when, in 1838, he measured the distance of the first star so studied, although his base line was 186,000,000 miles long (the diameter of the orbit of the earth around the sun). It took years for him to make the calculations by which the distance of 61 Cygni, in the constellation of the Swan, was fixed at forty trillion miles.

So laborious did such work prove that the distances of only 60 stars had been fixed up to 1900.

After that the Yerkes Observatory undertook to fix the distances of other close stars by photographic methods. Hold your pencil in an upright position before your eyes, about eight inches away, and then look at a picture on the wall ahead of you. Note the change of position of the pencil with reference to the distant picture when

Photograph from Yerkes Observatory

THE LATE ALVAN CLARK, OF CAMBRIDGE, MASSACHUSETTS, AND HIS GREATEST TELESCOPE LENS

Mr. Clark is seen at the left, with the 40-inch Yerkes refractor lens, the largest ever built. It was he who, with the lens he had made for the Dearborn telescope, was able to show that Sirius is a double star, thus proving Bessel's famous prediction. A refractor telescope uses a lens through which the light of the star passes on its way to the eyepiece. In those instruments having concave mirrors the light is reflected from the mirror to the eyepiece, which may be either at the top or the side of the telescope. The Yerkes refractor is the world's largest instrument of that type, and the 100-inch Mt. Wilson reflector (see illustration, page 109) is the largest of the mirror type.

viewed first from one eye and then the other.

Now, if you can imagine the picture on the wall as an infinitely remote star, the pencil as a comparatively near one, and the diameter of the earth's orbit as the distance between the pupils of your two eyes, you will see that photographs taken six months apart will show that the closer star has moved on the plate with reference to the remote one.

By the measurement of this displacement the distances of stars up to 373 trillion miles have been calculated.

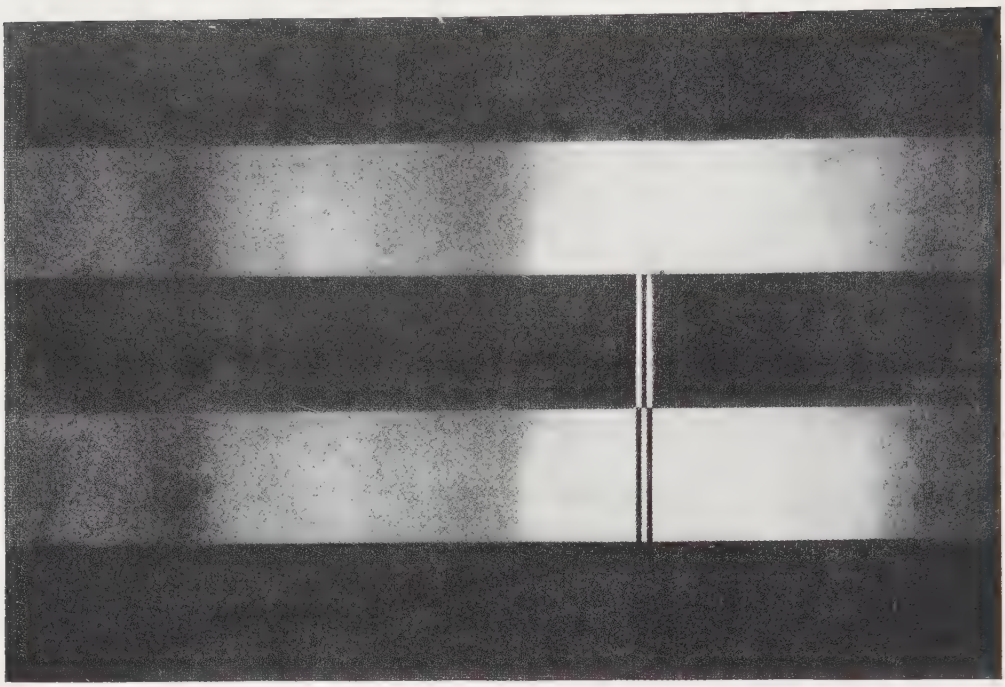
There are, however, distances to be measured for which even this method proves utterly inadequate, but for which new base lines have been found.

The sun and his family are driving through space toward Vega at the rate of 12 miles a second. In twenty years this flight gives a base line 40 times as long as the diameter of the earth's orbit, and the change of position of relatively near stars as compared with vastly remote ones is correspondingly larger.

It is a thrilling privilege to sit down with an astronomer and watch him measure these distances on his photographic plates. With a machine he calls a comparator he can measure distances down to 1/250,000 of an inch.

THE FLYING MINUTES FIXED FOR AGES

The photographic plate is an invaluable ally of the astronomer. It can see what the eye has never been able to behold. The eye becomes tired of looking and looking, and the fainter stars can never register on the human retina, even with the greatest telescope. But the light effect of one of these stars on the grains of sensitive silver on the plate is cumulative, and for hours and hours the light



Photograph from Mt. Wilson Observatory

THE THREE GREAT TYPES OF SPECTRA THROUGH WHICH THE STARS TELL THEIR STORIES

When light comes into a spectroscope from a solid body glowing with white heat, it presents the ordinary prismatic colors of the rainbow. When the light comes from glowing gas, instead of from a solid, it gives a black band crossed by bright lines as shown in the middle band of the picture. But when it comes from a solid glowing body and passes through a cooler gas, like the atmosphere of the sun, it gives a prismatic band, but crossed by dark lines, as in the lower part of the picture (see text, page 106).

of a given star may be held on a definite spot on the plate, building up its image to a perceivable magnitude.

On the plate the flying minute is fixed forever, and at will the bit of sky it covers may be revived, although generations may have passed since the photograph was taken.

Appreciating the value of a vast directory of the stars which would show their relative positions on given dates, eighteen great observatories in all parts of the world undertook to make such a directory of all stars down to the eleventh magnitude. The record has been finished and contains some six million stars.

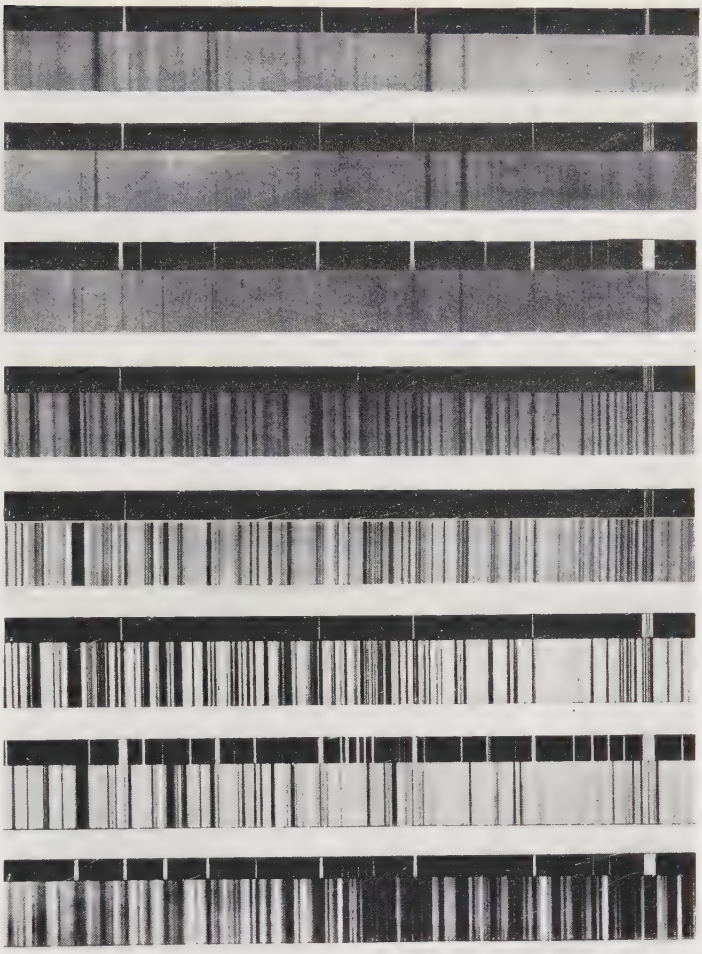
Imagine the inestimable value of these plates a thousand years from now, if they can be made to endure. Compared with similar plates taken then, they would reveal the changes in the celestial map in ten centuries. Nothing could serve better to clear up the mysteries of the universe than such a comparison.

Yerkes and other observatories feel that there should be established an adequate depot where these vastly important records can be stored under conditions that will protect them against the menaces of fire, tornado, earthquakes, and other cataclysms for a thousand years, and are looking for the far-visioned man who, by endowing their care, would transmit these invaluable records to the people living a millennium hence.

THE STORIES THE CENTURIES WILL TELL

Nordmann, after speaking of some of the marvelous things that the studies of the stars have revealed, says that all these results are nothing in comparison with those which the generations that come after us will discover, as from century to century they rephotograph these stars and compare their plates with ours.

Projecting upon a screen the negatives made to-day and those made in the centuries that follow, he says that the student will be able to review in a few moments the age-long history of the universe, with its vicissitudes, in which some stars have been born, others have grown to maturity, others have passed down the hill, and still others have joined the mute and silent and lightless procession that passes behind the coffin of Time.



Photograph from Yerkes Observatory

CODE MESSAGES FROM EIGHT FAMILIAR STARS

These messages are brought on the wings of light and placed on photographic paper by means of the spectroscope. Above each broad band is a narrow black one. These are the keys by which the astronomer translates the message. From top to bottom, the messages are from Mirzam, Rigel, Sirius, Mirfak, Sun, Arcturus, Aldebaran, and Betelgeuse.

THE WINGS OF LIGHT

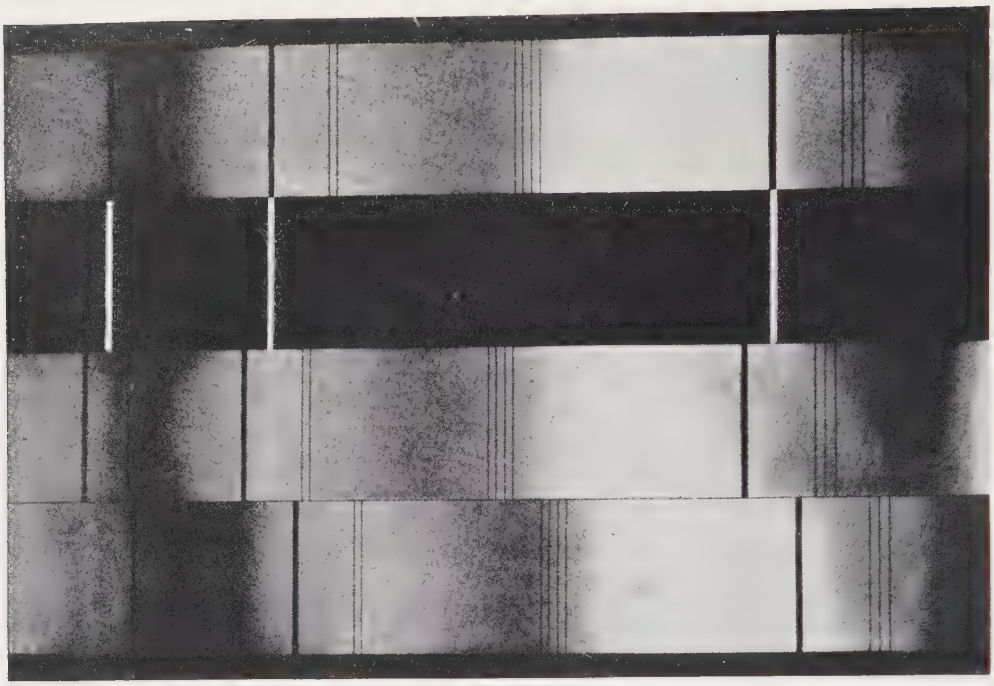
One who has seen the infinite pains to which the astronomer has gone to measure the distances of space gets a better comprehension of the scale of the universe.

If we could travel out through space in a series of journeys on the wings of a light wave, we could get a lively appreciation of the span of the heavens. We could go to the moon in a single second; to the sun in about eight minutes; to Neptune in a little more than four hours.

If we wanted to visit our closest star neighbor, Proxima Centauri, which, under measurements made at Cape Town, has recently supplanted Alpha Centauri as the nearest known fixed star, we would have to prepare for a nonstop flight of four years. To visit Sirius would take over eight years on the outward voyage, and, having arrived, we would find the Dog Star 33 times as bright as our own sun.

To go to Altair we would have to make a flight lasting 15 years, although our speedometer were registering more than 11,000,000 miles a minute. We would find the running time to Vega and Arcturus about 30 years, and when we got there would discover that they were each 80 times as bright as our own sun.

To reach Capella we would have to make a nonstop flight of 47 years' duration, and on arrival would find it to be two stars instead of one, each 100 times as bright as our sun.



Photograph from Mt. Wilson Observatory

SPEED RECORDS WRITTEN BY THE STARS

The second, or black band with the white lines, is the laboratory-made comparison spectrum. The joining of the black lines in the top band with the white ones shows that the star that told its story in the top band was traveling in a direction that keeps it a uniform distance from us. The lines in the third band, displaced toward the left from those in the second, say the star which wrote the record is receding from us and gives its velocity of recession. The lines in the fourth band, displaced to the right of those in the comparison bright lines, proclaim that the star which wrote them is coming toward us and tell the astronomer how fast it is coming (see text, page 108).

If our fancy turned us to the Pleiades, we would have to fly more than 11,000,000 miles a minute for 325 years. Arriving there we would find them to be a group of from 300 to 500 stars, filling a niche in space about 180 trillion miles in diameter.

And then, if we wanted to visit that marvelous star in Orion which we call Rigel, we would have to outfit ourselves for a journey that would last 500 years. Arriving at Rigel we assuredly couldn't land, for it is 13,000 times as bright as our sun.

THE DISTANCES OF THE SUNBURSTS OF THE SKY

It would seem that any star that was 500 light years away, when the solar system is only a little more than eight light hours in diameter, ought to be near the limit of things finite.

But great as are these distances, they are short journeys compared with some we could take.

For instance, there are the star clusters, those wonderful sunbursts of the heavens that reveal themselves in such striking beauty in a high-power telescope.

The fine cluster in Hercules, estimated to contain a million stars, has some 35,000 that are from 1 to 1,000 times as bright as our sun. If we wanted to visit that cluster we would have to equip ourselves for an outward light-speed journey of 36,000 years. The globular cluster known as Messier 79 is 85,000 light years away. It has been likened to a silent and crowded swarm of gleaming celestial bees.

The spectroscope tells the astronomer that the Hercules cluster is approaching 195 miles nearer to us every second. A swarm of stars with a total mass equal to 100,000 of our suns, moving hither

and yon among themselves, and yet possessing a swarm velocity of 195 miles a second! No wonder the brain staggers when trying to get a conception of the universe!

But if the full picture is drawn, we must realize that clusters have been found which are 200,000 light years away; yet so definite is the law of the conservation of energy that, even after traveling through all these two thousand centuries, the wave messengers from these inconceivably remote clusters are still able to deliver to the astronomers their reports of conditions existing in those clusters when they started on their journey (see illustration, page 115).

ARE THERE OTHER UNIVERSES LIKE OUR OWN?

But at what some distinguished authorities believe a still greater distance, float a million spiral nebulæ.

If the conclusions which the evidence is forcing astronomers to reach are warranted, they lie at distances which range from 500,000 to 10,000,000 light years away from us and appear to be other "universes" like our own, yet so distant that their stars cease to be separately discernible in the most powerful telescopes.

To these instruments they appear as small and vapory spots "formed by two spirals rolled together, like silvery snails exhibited in the garden of stars."

The grounds on which they are believed to be systems like our own galaxy, with their own Milky Ways and star clusters, their own constellations and suns, their own planets and satellites, are numerous.

When their light is analyzed in the spectroscope, it does not give the lines of gaseous material, but rather lines that might be expected from stars so remote that we can get only the glow of the group and not their individual light.

Still further, all the *novæ*—stars that suddenly flare up and then wane—occurring in that part of space which clearly belongs to our universe occur in our Milky Way. They all attain the same maximum brightness.

It has been found that these novæ also occur in the spiral nebulæ, and that their behavior and course are identical with the novæ of our own Milky Way.

Several years ago a great debate was held under the auspices of the National Academy of Sciences, in the National Museum, in Washington, between two leading astronomers, representing two schools of thought, as to the significance of the spiral nebulæ, the one school urging the conception that they were "island universes," and the other arguing that they were parts of our own system.

But the discovery of novæ in them has since converted some who challenged the "island universe" idea, and it has just been announced that Dr. Adams, at Mt. Wilson, has secured definite proof that spiral nebulæ are indeed isolated systems, perchance as great as our own, each separated from its neighbors by vast oceans of untenanted void, and each possessing its billions of stars, even as our own.

When dinosaurs roamed the earth the light waves that proclaim their existence had already started on their inconceivably long journey to the telescopes of the astronomers of to-day.

STAR DUST BECOMES COSMIC CLOUDS

These fleeting glimpses at other "universes" than our own will perhaps the better prepare us for some further wanderings while we explore the stuff of which stars are made.

In many sections of the sky are found black spots and hazy wisps of light that are readily differentiated from the spiral nebulæ, both as to distance and constitution.

For years these "coalsacks," "holes in the heavens," and "glowing clouds" mystified the astronomers, but recently even they have been forced to submit to interviews that have led to some startling admissions.

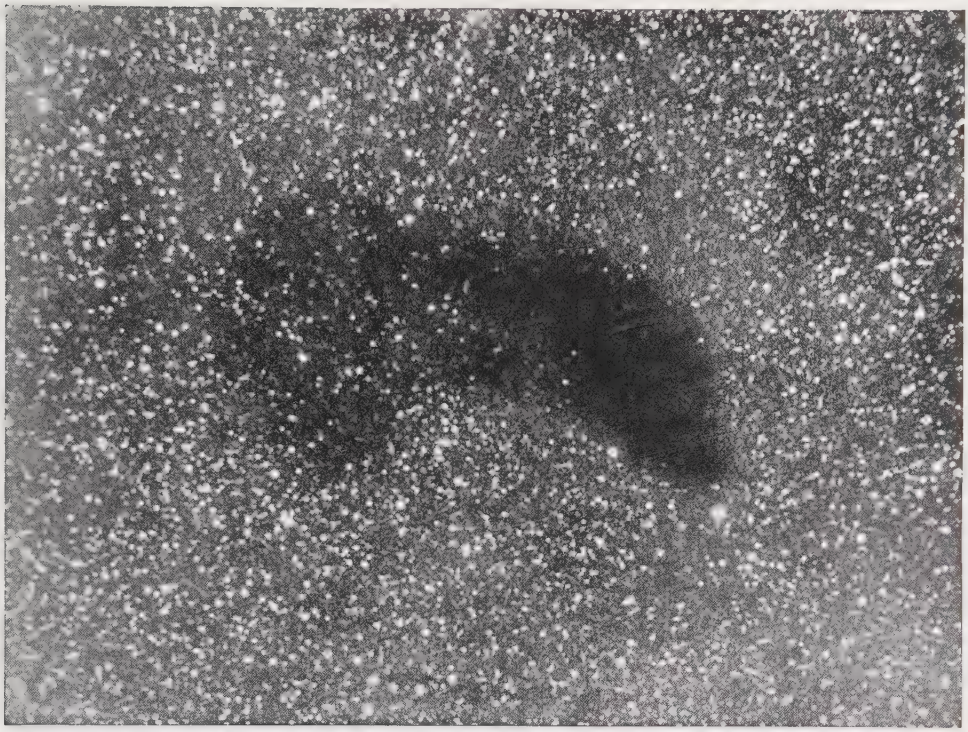
It has been found that light, whose pressure on earth is so feeble as largely to escape notice—unless we look at those little multivaned radiometers turning in their vacuum cases when the sun is shining in an optical-goods show-window—exerts a tremendous pressure in the hotter stars.

Even in the sun this pressure amounts to ten times the gravitational pull on tiny particles of dust of certain densities, and in the hotter stars it may be ten times as great.

Photograph from Mt. Wilson Observatory

LIGHT AND DARK NEBULÆ IN THE CONSTELLATION OF ORION

In the upper left corner is the bright nebula in the sword handle of Orion, and in the center of the picture the head of the huge obscuring mass that blots out every star shining behind it, just as our own clouds at times shut out the light of the moon and the stars at night. These types of nebulæ are regarded as immense clouds of dust driven by the pressure of light into empty space, and finally, under the forces of gravitation, condensed into great stars like Antares (see text, pages 117 and 119).



Photograph from Mt. Wilson Observatory

A DARK NEBULA IN AQUILA

The spiral nebulæ have been found to be traveling away from or toward us at the rate of 500 to 600 miles per second. Light that comes into the telescope from them to-day brings us records of what was happening in them when dinosaurs were roaming the earth. Thus does the Past live in the Present and project itself into the Future in the field of astronomy.

So that every bright star exudes oceans of cosmic dust particles and inconceivable numbers of free electrons, which, pursued through space with the whiplash of driving light, must move on and on, forever seeking company and finding it.

CELESTIAL CLOUDS WITH "SILVER LININGS"

Finally great clouds of this cosmic dust form. If these vast clouds occur in regions remote from stars they are dark and forbidding, the "coalsacks" of the heavens; but if they chance to form in regions peopled by stars, they become cosmic clouds with "silver linings." In some cases the spectroscope reports that the light is merely reflected star light, while in other cases the star light clearly arouses within the dust a glow of its own.

"Star dust" has long been a figure of speech, but now it has come to have a literal as well as a figurative meaning.

Nordmann, the eminent French astronomer, offers the climax to the story. These huge, shapeless nebulæ form "the breeding ground where stars are born."

The theory generally held as to how stars come into being is that the accumulating clouds of cosmic dust become so heavy that gravitation begins to draw together the particles that constitute them.

As the process goes on, the flying molecules begin to collide with one another. These collisions stir the electrons in their atomic orbits, and heat is generated, with the result that the mass begins to glow—now red, now yellow, now white, and now blue—as contraction goes on and temperature rises.

It has now reached the limit of contraction, and we have a star of the Rigel type, 13,000 times as bright as our sun. The star is in its prime. The vast pressures and terrific temperatures resolve all matter to its simplest form. No complex atom like that of iron could hold together amid such frenzied surroundings any

Photograph from Mt. Wilson Observatory

AN EDGE-ON VIEW OF A SPIRAL NEBULA IN VIRGO

The majority of astronomical opinion has come around to the idea that the spiral nebulæ are "island universes" so far removed from our own stellar system that no telescope can separate the light of the stars that compose them. Their messages through the spectroscope indicate that their light is starlight, and the million of them that have been found seem, without exception, to have the watchcase shape that characterizes our own stellar system (see text, page 117).

more than an ice crystal could defy a blowpipe, or a nitroglycerin molecule resist an electric spark.

So here hydrogen and helium are the dominant elements.

DOWN THE HILL IN STAR LIFE

Then cooling begins. The star has passed the top of the hill of its life. As the millions of years, that are but the ticks of a clock in its life span, roll on, the journey toward the grave begins. Again a white star, but now a dwarf, the temperature is falling, and the hydrogen and helium are condensing into more complex elements. Still further cooling, it becomes a yellow dwarf, like our own sun. Here the temperatures become low enough to permit the formation of more complex elements and even compounds.

Other millions of years pass, and the star that began its career as a red giant becomes a red dwarf. It is on the borderland of death. Presently, remembering that millions of years are but moments in star existence, the red glow ceases and the dying star passes out into the realm of things unseen.

How many of them must there be floating around as lightless derelicts in the oceans of space! How many hundreds of human beings are dead for every person that lives! And yet the life of a star, long as it is, is probably not longer in proportion to the life of the heavens than is the life of the individual in proportion to that of the race!

The earth and the moon, though different in their origin, typify the end of every star—cooling until the crust forms, the only light it can now give being such as it borrows and reflects from some other star.

THE PROBABLE LIFE HISTORY OF OUR SUN

It is believed that in its youth our sun was, perhaps, as large as Antares, and as

red, and that it may even have filled the space within the orbit of Neptune.

The matter composing it at that time may have been even more attenuated than the air in the vacuum tubes of a modern radio set. But as the ages went by, these particles came closer and closer together, the temperature rose higher and higher, and the hue changed progressively until it reached the blue-white of a Rigel, 13,000 times as bright as it is now.

Then it began to cool, a process that has covered eras that make centuries seem no longer than seconds appear to us.

Finally there swept past the region it occupied some wandering star. It may have passed millions of miles away, but at that it came close enough to stir vast tides on the surface of the boiling sun, even as the pull of the moon raises tides upon the seas of the earth.

Finally the tide rose so high that a vast elongated drop of the molten material was pulled away—a drop with a fair-sized head, a huge waist, and a small tail, like a drop of water starting from the lip of a faucet.

This great drop of molten material became the planets, subdividing so that the tip of the tail became Mercury, the waist Jupiter, and the head Neptune, the other planets getting their appropriate positions.

As the passing star moved on, it imparted to the drop thus pulled away and subdivided a swing in orbits that the planets now possess. And so the sun that was became the solar system that is.

MARS AND ITS SECRETS

What of these planets to-day? Is Mars inhabited? Are there canals on its surface? Do other stars have planetary systems like our own?

When Mars came closest to the earth last summer I was visiting some of America's leading observatories. While the people were intensely interested in what this approach would disclose, the astronomers, with few exceptions, were much less so, for they knew that in 1924 Mars crossed the heavens far south of the zenith. To look at it with a telescope then meant the viewing of it through a much greater depth of atmosphere than would be encountered with the planet crossing near the zenith.

Two years hence Mars will cross the sky at a much higher elevation from the southern horizon, and what will be gained by increased visibility will more than compensate for what is lost by increased distance.

Mars is the most observable of the planets. Venus hides herself in clouds that prevent a good look at her surface; but the atmosphere of Mars is less dense, so that the man at the eyepiece of the telescope can see the planet's surface with clearness and distinguish various geographical features. Among these might be mentioned the polar caps, which have a way of advancing in the Martian winter and retreating in summer (see page 108).

ARE THERE CANALS ON MARS?

A recent series of photographs of Mars, taken by W. H. Wright, at Lick Observatory, with infra-red and ultra violet light, give evidence that the planet has a denser atmosphere, however, than was hitherto suspected, and this may scatter and absorb visible light in much the same way as the earth's atmosphere. Even the "polar caps" seen through the telescope with visible light may be, according to Mr. Wright's conclusions, clouds or banks of haze overlying solid caps of smaller dimensions on the surface of the planet.

Besides these caps, there are certain features that look not unlike continents, one even reminding the observer of the projection of India from the continent of Asia.

With reference to the "canals" that some observers have believed they could see, it is to be said that none of the larger telescopes have ever revealed them.

The irregularity of the edges of the polar caps indicates that the surface of Mars is no more nearly level than that of the earth, and yet the narrowest canal-like markings the big telescopes reveal must measure 50 miles in width, and the widest nearly 200 miles. Some of them would be 3,000 miles long.

When some one inquired of Prof. Edwin B. Frost, the director of the Yerkes Observatory, if the Martian canals could be seen with the big 40-inch telescope there, he telegraphed the laconic answer: "Yerkes telescope is too powerful."

The late Simon Newcomb showed how easily an astronomer with a low-power telescope might be deceived as to what he saw on the surface of Mars.

At an astronomical convention, Dr. Newcomb made a large white disk. On this he put all sorts of irregular markings resembling those a powerful telescope reveals on Mars. Exhibiting it at a given distance from his fellow astronomers, he asked them to draw what they saw. And when everyone had finished his drawing, not one of them had the irregular markings on his drawing, but all had straight lines resembling the "canals" that observers with small telescopes believe they see, indicating that the small separating power of the eye at that distance was responsible for the "canals."

The question naturally arises whether any other star has a system of planets like our own solar system. This is a question that perhaps can never be answered by direct observation, for there is no present reason for hoping that any telescope can ever be built powerful enough to see such planets shining only by borrowed light. But reasoning by analogy, it is hardly probable that, among nearly two billion stars in our universe, ours should be the only one with a family of planets. We might think that our earth is the only planet with a moon, if we had to depend on our eyes.

DOES LIFE EVER PASS FROM STAR TO STAR?

Then comes the question of interplanetary and interstellar communication of life. Biology has demonstrated that there are forms of life that go into a deep sleep when placed in a high vacuum and surrounded with temperatures approaching that of space. With all that is now known of cosmic dust and its movement through space, there is certainly reason for believing that suspended life, in its lowest forms, might pass from planet to planet or even from dark star to dark star.

Much the greater difficulty would come in finding a suitable environment for the waking bit of life on a new planet or another dark star.

The astronomer and the physicist, in their quest of the truth about the constitution of matter, employ theory and experiment with startling success. Now gathering a mass of clearly related facts, now formulating a theory that will explain these facts and their relationships, now putting that theory to the acid test of proof that in no other way could the accumulated facts be explained, they march on, pushing back the horizon here, lifting the veil of mystery there, and, step by step, getting that knowledge of the behavior of matter which enables the applied scientist to manipulate it for the promotion of human good.

Last summer, at Mt. Wilson, Dr. and Mrs. Charles G. Abbot gave the world a spectacular demonstration of how closely applied science may follow in the wake of theory and experiment. Dr. Abbot, following his studies of the sun, had devised a solar cooker—a sort of trap in which to catch sunbeams and make them take the place of mundane fuel in cooking and baking. He was so successful that piping hot things came to their table all season done to a turn by heavenly fires 93,000,000 miles away.

THE TASK THAT CHALLENGES

If the human race expands from 1925 to 2035 in the ratio that it expanded from 1804 to 1914, the earth will 110 years hence have a population of more than four billion souls.

To feed them, to house them, to provide them with transportation and clothing, and to meet the other multiplying needs of a civilization growing ever more complex, is the task that confronts the applied scientist. But ahead of him must ever go pure science, laying the foundations of truth upon which must be built the superstructure of human progress.

Mt. Wilson, Yerkes, Lick, and the other great observatories of the earth are helping to lay these foundations. And upon their success and the success of their congeners in other fields depends the welfare of our children's children and the other billions of people whom the centuries are adding to our population.

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CAIRO TO CAPE TOWN, OVERLAND

An Adventurous Journey of 135 Days, Made by an American Man and His Wife, Through the Length of the African Continent

BY FELIX SHAY

SINCE the previous spring, Porter Shay and I had been adventuring from the high Inca-Andes to the plains of Mongolia, from the South Seas to the border of Afghanistan. We completed our tour of India in the intense heat, in the midst of an outburst of plague.

The English newspapers brought on board the P. & O. Steamship *Mantua* at Bombay were full of the wonderful discoveries by Lord Carnarvon at the tomb of Tutankhamen. Half the deck and dinner-table conversations were given over to that subject. The presence on board the ship of Lady Porchester, the wife of Lord Carnarvon's son, gave pertinence to the inspired gossip. We Americans were especially interested, for Lady Porchester is an American girl.

EXPERTS SAID THE TRIP WAS IMPOSSIBLE

The odd and curious tales told about Lord Carnarvon, about Egypt, about Africa, stimulated old desires to see inside Africa. There we were, world-weary and travel-tired, with Paris and a chair on the boulevards in sight, deliberating on an unpremeditated jaunt to another of the "out places."

Perhaps we were a little sun-touched. Perhaps the "out places" call to us more than do the boulevards. I only know we discussed Central Africa seriously and enthusiastically while the ship moved with caution through the Suez Canal toward Port Said.

That night on board we submitted our proposition to the council of friendly colonels whose life work it is to keep the British Flag flying where the sun never sets.

"Into interior Africa without equipment, supplies, or guns? Cairo to Cape Town overland? Oh, I say, you cawn't do that, Old Chap! Besides, it's the wrong season. You cawn't travel Central Africa in the summer. Have an iced drink instead!"

In America two years before I had sought information on the general subject of the Cairo-to-Cape-Town Route overland. I addressed an endless number of letters and inquiries, and was directed and redirected here and there, to no purpose. When I completed my inquiry, Africa was still the "Dark Continent" to me.

So it was the morning we anchored in Port Said.

FIVE THOUSAND MILES TO THE CAPE AS THE CROW FLIES

In spite of all the uncertainty, all the scoffing, all the jesting, we leaned over the rail and smiled at the gesticulating Arabs in the little boats—smiled at them and at each other. Maps or no maps,

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PASSING THROUGH THE SUEZ CANAL

This famous waterway has been called the "jugular vein of the British Empire." During the World War Germany attempted unsuccessfully to cut the "vein" by sending submarines to wait for ships near the long channel through the shallow shore waters natural to this part of the Mediterranean. The Suez Canal is 100 miles long, in contrast to the 40-mile Panama Canal. It is a sea-level canal, having no locks. Until 1923 the traffic passing through it exceeded that handled by the Panama waterway. In that year, however, the American canal's shipping exceeded that of Suez by 2,000,000 tons.

equipment or no equipment, we were going to Cape Town *overland* through Central Africa (see map, page 128).

Decisions like that make themselves.

Some people know one part of Africa; some another; but to meet one who had traveled the full distance from Cairo to Cape Town overland was not to be numbered among our pleasures.

Authorities in Port Said and Cairo advised me: "This is the rainy season. You will run into sandstorms in the desert, floods in the Sudan and Uganda, and you will have to walk at least 400 miles, much of it through the deadly tsetse-fly, or sleeping-sickness, country. Don't try it with a woman. You will never get through."

From Cairo to Cape Town is some 5,000 miles as the crow flies. As one travels the way one must travel, the route totals twice the distance from New York to California. Transcontinental railroads in Africa are figments of the fertile imagination. Cecil Rhodes' All-Red Route is still but a red line on the map.

The ticket agencies in Port Said were able to sell us railroad tickets to Khartum, in the Sudan, beyond which a boat operated on the Nile, but they were uncertain as to whether or not it was able to move at that season of the year, because of low water and sand bars in the river. They recommended that we wait until the following winter before making the experiment.

Instead, we booked for Cairo and Khartum.*

THE START FROM CAIRO

Cairo is no longer an Eastern city. It is a cosmopolitan city with a strong French flavor. The English until recently occupied Egypt, but the French have captured the Egyptian imagination. They say when a good Egyptian dies he goes to Paris.

The first morning our dragoman took us to the Sudan agent's office. There two kindly gentlemen displayed genuine interest in the proposed trip. They sincerely tried to help us. For an hour we were permitted to study maps and routes through the Sudan and Uganda. We came away full of confidence for the first lap of the journey.

They gave us a special Sudan Permit, which is necessary for those who plan to enter that country.

Then we called on the Belgian Consul to secure a visé for the Belgian Congo, and at the British Consulate for visés for Uganda, for Kenya, for Tanganyika, for Rhodesia, and the Union of South Africa.

That afternoon, on the terrace at Shepheard's, we sketched an arbitrary route on the map and presumed to put on paper a theoretical schedule, according to the best available information. The schedule indicated that we should arrive in Cape Town in 73 days. Ultimately we arrived in Cape Town in 135 days.

A NIGHT'S RIDE BY SLEEPER FROM CAIRO TO LUXOR

Cairo was a familiar scene to us, so we moved south the second day. The train with the International sleeper left Cairo at 8:30 p. m. for Luxor. It arrived at 9 the next morning.

At Luxor we crossed the Nile in a small Arab *dhow*. The donkeys were waiting on the far side to take us to Tutankhamen's tomb.* Off we jogged along the embankments that separate the fields where the fellaheen work.

When the donkey boys learned we needed no assistance, they linked arms like three dusty musketeers and followed after, singing Arab songs in a high, wailing, monotonous voice.

The fellaheen, cultivating only the banks of the Nile and the flats which benefit by its overflow, farm as they did in the days of Mohammed, plowing with bent sticks and irrigating their fields with water raised from wells by camels hitched to a kind of spindle and water wheel. Bullocks, driven around in a perpetual circle, tramped and threshed the grain as in Biblical times.

We rode toward the historic hills. Nor did we hurry, because the ride in the warm, clear air, in the bright sunlight, was a joy in itself.

Along the path unwashed children, with

* See also in the NATIONAL GEOGRAPHIC MAGAZINE "Along the Nile, Through Egypt and the Sudan," by Frederick Simpich, October, 1922, and "The Barrage of the Nile," by Day Allen Willey, February, 1910.

* See also "At the Tomb of Tutankhamen," by Maynard Owen Williams, in THE GEOGRAPHIC for May, 1923.

FISHING BEHIND DE LESSEPS' BACK AT PORT SAID

The gigantic statue of de Lesseps looks out upon the parade of commerce this French engineer's vision and energy made possible.

Photographs by Maynard Owen Williams

HUMAN CONVEYOR BELT AT PORT SAID

A temporary hitch has occurred in coaling a ship. But hitches do not last long. The queues of natives at Port Said, carrying coal cheaper than machinery can do it, add weight to Kipling's lines, which put the Orient "somewheres east of Suez."

Photograph by Maynard Owen Williams

AN AMERICAN IMMIGRANT STRUTS IN AFRICA

Proudly surveying Port Said, a turkey gobbler stands untied on his pedestal of a native poultry-seller's crates while a jury of citizens from time to time passes upon his worthiness to die. Another immigrant from the Americas, the peanut, has penetrated innermost Africa more easily than explorers. Durra flour, from a cereal grass, and "goobers" are a staple diet for millions of natives. Though popular in America and Africa, peanuts are eaten only by the poor in Europe.

the limpid eyes of Arabs, put out dirty little hands to us and begged *baksheesh*. We waved at them and answered with an Arab greeting. Many of them had black woolly lambs in their arms as pets.

Cynics say the first word an Arab baby learns is "baksheesh."

In color these Arabs range from coal-hole black to taffy yellow. From Luxor to Khartum the Arab and the Negro have become a blend.

The hills beyond the Nile are of barren, crumbly rock. Sand blows over all and submerges all. Where water touches Egypt, there is a garden; where no water touches, a barren waste, desolation itself.

Our road led through cane fields and watermelon patches.

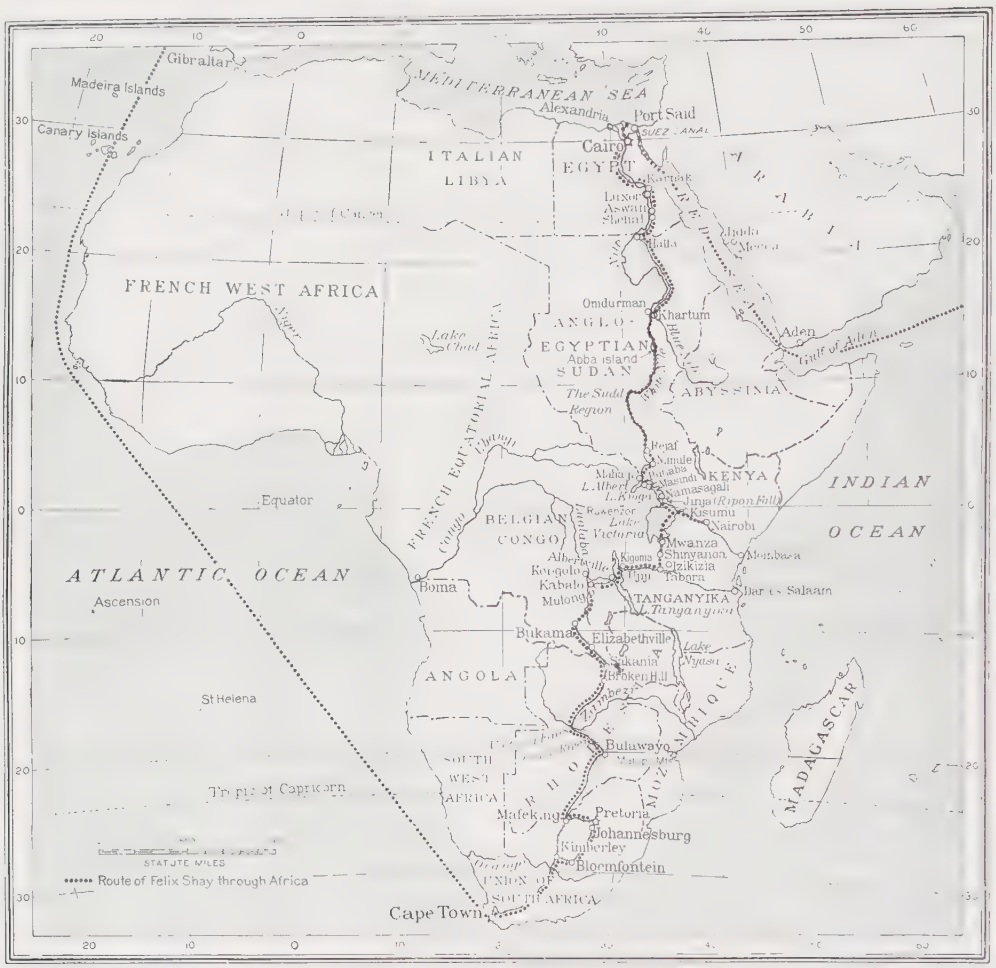
These cane fields make fortunes for the fancy-dressed Egyptians who frequent the sidewalk coffee shops in Cairo. One year's return from the crop repays the original investment; thereafter the income from the fields is a gift from Allah.

To attract our favorable attention, the donkey boys repeated time and again, "All right! Good morning! Day not hot! Nice day! Americans nice people! Hip, hip, hooray!" They had to run all day to keep up with us, and for all their good humor, their work was trying. There was more than enough dust, which blew full in their faces, causing frequent fits of coughing. We encouraged them to take short cuts across the fields to escape it.

Gaunt Arabs passed on tiny donkeys, riding astride, without stirrups, their sandaled feet turned out at right angles (see page 141). Groups of barefooted Mohammedan women, swathed in blue cotton, returning from the Nile with water jugs on their heads, padded by.

IN THE VALLEY OF THE KINGS

The Valley of the Kings is a crater-like depression behind the first range of hills. The walls are of limestone rock, steep and abrupt. For centuries the sand



Drawn by A. H. Bumstead

A MAP OF AFRICA SHOWING THE AUTHOR'S ROUTE FROM CAIRO TO CAPE TOWN

The dream of Cecil Rhodes—a railroad from the mouth of the Nile to the Cape of Good Hope, through British-controlled territory—is still very much of the substance of which dreams are made. It took Mr. and Mrs. Shay 135 days to make the trip overland, traveling by river and lake boats as well as by train, and bridging two gaps on foot through tropical regions. For greater detail see the National Geographic Society's New Map of Africa (size, 32 x 28 inches), in six colors, issued as a supplement with THE GEOGRAPHIC for October, 1922. Separate copies are obtainable from the headquarters of The Society, on paper, at $1 each; linen, $1.50.

of the desert swept down over the rim of the valley and in places almost filled it.*

Most of the tombs of the ancient Egyptian kings in the side wall, which have been exposed by excavation, are on the same level, but Tutankhamen's is on a lower level, directly under the tomb of Rameses VI.

*See also in the NATIONAL GEOGRAPHIC MAGAZINE for September, 1913, "Reconstructing Egypt's History," by Wallace N. Stearns; "The Resurrection of Ancient Egypt," by James Baikie, and "The Sacred Ibis Cemetery and Jackal Catacombs of Abydos," by C. M. Cobern.

Italians, French, English, Americans—men of many nations—have made discoveries in this valley, but the tombs of most of the kings were robbed long years before, and much of the incidental treasure was stolen. Even the walls of the tombs were ruthlessly mutilated by the vandals, the hieroglyphics being cut out in blocks and sold to unscrupulous dealers and collectors.

The Arabs stole; collectors and dealers bought. The Arabs say, "The antiquities belong to him who finds them!"

Photograph by J. Blackburne

AN AIRPLANE VIEW OF ONE OF THE NILE BARRAGES

Dams are used to conserve water, barrages to direct it. Several barrages have been built across the Nile to send its flow into irrigation canals. Fifteen miles below Cairo a barrage has been constructed to control the water level in the Nile Delta, as an aid to navigation as well as to agriculture.

The opening into the tomb of Tutankhamen is in the floor of the valley. When we arrived it was covered over and walled in, with the tent of the Egyptian soldiers detailed for guard duty five yards away. A narrow-gauge railway was being transported in sections on camels' backs and deposited near by. Other camels were bringing stout little steel-wheeled baggage trucks to remove the treasure from the tomb.

Closed, the tomb of Tutankhamen appears to be simply a stone wall with some loose dirt before it. Open, it is exactly like the near-by tombs, except that it was the resting place of a monarch rich in the accouterments of death and had escaped the depredations of grave robbers.

The find was valuable because it revealed an authentic chapter of Egyptian history, unaltered and undefiled. To the scientific mind it represented the reward of a life's work, a hope fulfilled. To the lay mind, the tourist mind, it was another place to go and gaze upon. To the hotel-keepers, shopkeepers, and dragomen of Egypt it was, and is, the chance that comes once in a generation.

GAZING UPON THE CALM COUNTENANCE OF ONE OF THE PHARAOHS

In one of the royal tombs we saw the mummy of a king, Amenophis II. We gave the Arab guard a little baksheesh to find a secret way into the walled-off chamber. We had to scramble down into the dark, where there were no stairs, to a lower level, with only a candle for light—like slipping and falling into a grave.

At the bottom, in a small stone room, was a huge sarcophagus. The king lay, with the calm dignity of death upon his face, his shoulders and chest exposed, a

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THE SUGAR-CANE MARKET NEAR HASAN MOSQUE, CAIRO

Scientific irrigation has led to increase of Egypt's sugar-cane crops, particularly south of Cairo. An inferior sugar cane, introduced from India, grown throughout the length of the Egyptian section of the Nile, is a native equivalent for chewing gum. Hasan Mosque, like many other minareted mosques in Cairo, is a combination church and school.

single garment draped around his lower body in graceful folds. "Mummy" is not the word! There lay a man. The preservation was perfection itself, though he had been dead some thousands of years.

His skin was blue-black. Whether that was the life color, I am unable to state, but I presume it might have been. Of a certainty, the Egyptians of old who lived in this Luxor-Khartum climate were not white men. The intense sun rays would have attended to that.

He had finger nails almost an inch long, and the hands were thin and finely drawn. His lips were a little too full for a white man's, but the nose was aquiline and high.

A VISIT TO THE SOCIAL CENTER OF QUEEN HATSHEPSUT, THE "BLUE LADY"

We climbed up the steep side walls, from the Valley of the Kings, to meet our donkeys, silhouetted against the sky, and went to the resthouse for luncheon.

Later, in the cool of the afternoon, we visited the ancient social center of Queen Hatshepsut, who might be called the Blue Lady because she made famous the blue glaze, so distinctive among Egyptian antiquities.

Porter saw a blue bead in the ruins. She said not a word to me, but searched until she found five more. Think of it! Six ancient Egyptian blue beads found by one's self! Do not the Arabs say, "The antiquities belong to him who finds them"? So she put them in her pocket. Then she searched some more, and presently she found three *green* beads and four *red* ones. But Hatshepsut favored only blue! The find proved to be glass beads off a very modern donkey's fly brush!

Soon we headed the donkeys toward the Nile. We passed Arab farmers, who greeted us with "Salaam, Sahib," and we replied "Salaam." We met Arab women, too, who did not cover their faces; working women cannot be bothered.

In Cairo all the Mohammedan women cover their faces—the ugly ones with black knitted veils and the pretty ones with sheer white chiffon, which reveals the face clearly and endows it with a glorified complexion.

Another day we visited the tombs of the lesser personalities; another, Karnak; another, we reviewed Luxor itself.

THE SUN'S GLARE STRIKES LIKE A BLOW IN THE FACE

The fourth morning, in a little white train, with blue-glass windows to lessen the shock of the rushing sunshine, we moved on toward Khartum through the desert.

Before we were a mile from the station at Luxor the desert began to assert itself. The temperature in the coach climbed to almost unbearable heights; yet when we opened the window for what we thought would be a breath of fresh air, the glare of the sun struck us like a blow in the face. We had never conceived of such violent sunshine.

Where it is hot—*hot*—people make friends quickly; no formalities or conventionalities seem worth while. So we soon learned to know the half dozen white men who were our fellow passengers.

The sun became hotter, the ride grew dustier, the desert became more and more like a desert. Outside the windows there was nothing but sand and heat and sunshine; inside, only heat and sand.

Occasionally we stopped at a railway station set in the waste. Voluble Arabs made the usual din, apparently about nothing.

Late in the afternoon we reached Shellal and transferred to a boat on the Nile for Halfa, whence stretches the railway to Khartum, completed by Kitchener between 1897 and 1899, when he made war on the forces of Mohammed Ahmed, the "Mad Mahdi," concentrated at Omdurman.

A VARIED GROUP OF PASSENGERS STARTS NORTH ON THE NILE

The Nile trip from Shellal to Halfa lasted from 5 o'clock one afternoon to noon of the second day. The boat was too small to permit the passengers to move about. There was nothing to do but sleep and eat, read and talk.

On board were two English engineers coming out to the new Blue Nile Dam above Khartum, which is to bring another million acres of land under irrigation for the cultivation of cotton; an English railroad man who had spent many years in the country; a physician from the English hospital at Omdurman; a Syrian physician bound for a sleeping-sickness area up south; an Arab-Egyptian official going back to his tropical post. Two itinerant Americans completed the boat's company.

For half the distance to Halfa the desert was saffron-colored, sienna, burnt orange; in the high light of noon it was golden.

Most of us think of the Sahara as composed of white or gray sand. To the contrary, it is colorful. Often the "sand" is broken rock, and there are many ledges and ridges. Everywhere the ground heaves and swells.

HALF THE DESERT ARABS SEEM TO HAVE SORE EYES

The desert Arabs live in desperate squalor, on the fringe. On what they subsist is more or less a mystery. The hot sun burns up their filth; otherwise they must of necessity all die. The Nile flows close by, but it is not used for bathing. Half the inhabitants seem to have sore eyes, and the sightless ones are everywhere.

Evidently the desert flies have been educated. To tell a fly, "Go away," means nothing to it. Always the Arabs were covered with contented flies. We shooed them away. They ignored the warning. They stayed where they were until they were killed. It is no simple matter to attempt to kill all the flies in the Sahara.

The heat in the cabins of the small boat was almost unendurable, so we turned out at daybreak and went on deck to breathe.

We saw the sun rise over the desert. A huge brassy disk slid into place with astonishing rapidity. One moment there was a soft haze; the next, a bright, hot sun assaulted the land.

Along the shore small palm trees grew delicately out of the water itself and gently waved green branches at us. Off

© Donald McLeish

A KORAN CLASS ON THE STEPS OF MUAYYAD MOSQUE, CAIRO

After they have learned the alphabet and how to count, instruction among Moslem children is confined almost entirely to the precepts of the Koran. Cairo is the educational center of all Islam. El Azhar University, probably the oldest in the world, in prosperous times has over 10,000 students. The course can be completed in 17 years, and after passing the final examination a diploma entitles the holder to teach there or in any similar institution. The students of this institution have been active participants in the recent political unrest in Egypt.

toward the horizon were hummocks and pyramids of crumbly rock. Near at hand an Arab mud village slept soundly and odorously.

Swarms of wispy gnats moved down from nowhere to settle in our hair for additional warmth.

The steersman, a Mohammedan, came out of the little deck house to say his prayers on the roof of the lower deck.

It is the season of the Feast of Ramadan. He faces Mecca. He stands. He lifts both gaunt hands. He drops his hands. He bows. He kneels. He prostrates himself. He lays his forehead to the deck. He repeats.

HOW THE ARABS LOST A CONTINENT

We were reminded of the conquests of the Arabs. They conquered the "Sudan" (Arabic for the "Country of the Blacks") and most of Equatorial Africa as well. Had they ruled kindly, Africa probably would have belonged to them. Instead, they used the continent as a reservoir from which to draw slaves.

We were not yet accustomed to hearing white men prattling in Arabic, a Semitic

language, the sound of which is very distinctive, but already we were beginning to "hear" separate words when they were spoken, and in a few days were able to indicate in Arabic to the serving boys what was wanted.

Each language seems to have its different set of gestures, and Arabic has more than Yiddish. Out on the shore we could tell when a European began to speak in Arabic, for immediately he brought his hands, arms, and shoulders into the conversation.

At midday the heat was so enervating that we would sit and eat in silence. Those of us who were new to the country ate very little.

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A NUBIAN WOMAN SELLING FRUIT IN CAIRO

Her costume is set off with a necklace of coins. During the World War much gold went up the Nile Valley for cattle and supplies. Bankers know it has not come out, and much of the gold, no doubt, forms the crowning glory of native gala costumes. Arab influence can be traced throughout the world by fruit. Isolated gardens of fruit trees in settlements on the Cape-to-Cairo route are the chief reminders that these places were stations for Arab slave raiders.

THE SUDAN IS A COUNTRY OF CALAMITIES

We asked one of our physician passengers if the Sudan were a prosperous country.

"Yes, on the face of it," he replied, "but a country of calamities. One year there is no rain. The next year we have a flood which washes away everything. A third year we have famine. Then the natives say they are bewitched and steal off into the jungle and refuse to work. One year we have malaria, and the next, sleeping sickness."

These doctors are literally giving their lives to save the black man from savagery and ignorance and disease. Only the lucky ones are likely to come out of the Sudan alive at the end of their period of voluntary servitude. When one dies, another comes in. Their salary is a pittance.

Medical missionary work yields about 100 per cent results.

At first the natives were afraid of the "medicine man" from civilization; but once their confidence was gained, the sick, the halt, and the lame crowded the hospitals.

In these back countries all white men are supposed to be doctors, which is a subtle tribute to the medical profession.

© Publishers' Photo Service

THE GREAT MOSQUE OF CAIRO AS SEEN FROM THE CITADEL

The metropolis of the Nile and largest city in all Africa does not trace its origin to the ancient Egyptians, but to Arab invaders. Its rise came not by chance, but by the strategic importance of a site at the Nile Delta head giving command of the river and trade routes east and west. Cairo spreads itself on the level plain between the east river bank and the hills.

All down through Africa we had a multitude of savages come to us with tragic and terrible ailments and ask us to cure them.

A PANORAMA OF HISTORY ON THE BANKS OF THE NILE

The only animals we saw in the desert were lean white camels. They browsed and grazed, apparently on nothing, or reclined on shadeless sands hot enough to burn the skin from one's hands.

The banks of the Nile are a panorama of history. We passed Philæ, the ancient shrine of Isis, which since the building of the Aswan Dam is submerged almost half the year. We passed a Roman fort high on a rocky and desert shore, set there to watch over the barbarians while Antony's romance with Cleopatra flourished. We passed a temple supposedly erected by Cleopatra herself—in a fit of remorse, we presumed to think.

When we came to a Temple of the Sun, carved out of rock, we were given an opportunity to land, and we entered its cavernous depths at night with torches that threw weird shadows.

We passed Kitchener's camp, where the great British soldier spent something like three years equipping an army with machine guns and artillery to go into the Sudan to subdue a religious zealot and his fanatical followers.

THE TRAIN SURRENDERS TO A DESERT SANDSTORM

The train from Halfa to Khartum was scheduled to leave at 1:30 p. m. one day and to arrive at Khartum at 4:00 the next afternoon. We arrived at our destination 18 hours late, having been marooned an afternoon and a

night in the desert with masses of sand hurtling over and around us.

During this sandstorm we rested at Number 6. These desert stations are numbered, thus adding the one touch necessary to complete their desolation.

We did not dare to go forward, for when these desert storms swirl often they blow the roadbed out from under the crossties and leave the rails suspended in the air, like bright steel ribbons. Eventually, before the full train was permitted to proceed, a hand-car had to be sent ahead as a scout to see if all were well.

It was late in the afternoon when the full force of the sirocco struck us, turning the daylight to darkness.

We were fascinated by its approach. Thin, angular Arab figures danced in its path, like grotesque scarecrows, trying to escape. It whirled across the Nile, striking us broadside on, and for a few stuffy minutes the air was unbreathable.

The storm carried all the sand and scenery with it. For a half hour we breathed dust, swallowed dust, and spat dust. Then it passed over, and we could watch it playing havoc on the horizon.

Late in the evening, when the moon came out, we sat on the bank of the Nile and exchanged experiences till long past midnight.

One man said, "When the World War was on, the black Sudanese sold cattle and foodstuffs in large quantities to the Allies. They were paid in gold, thousands of pounds of it. This gold has never been banked. It went into the Sudan back country and disappeared. What the natives did with it no one knows; perhaps they buried it. But the bankers know what they did not do with it; they did not bank it."

THE CITY WHERE KITCHENER WON FAME

Khartum was a welcome sight!

Luxor, Aswan, Halfa, Omdurman, and Khartum are river-bank villages. Because of their fame, one thinks of them as cities. Khartum plays at being the capital of the Sudan; Omdurman, just across the Nile, is an all-mud native village covering a vast area.

At Omdurman "Kitchener of Khartum" defeated the Kalifa, the successor to the Mad Mahdi.

The Anglo-Egyptian Sudan proper is a country of 1,000,000 square miles, one-third the size of continental United States, with an estimated population of 6,000,000.

Some day the Sudan will be a great cotton-growing land. England looks to it ultimately to supply the cotton she now buys from the United States. To-day England holds the Sudan with a skeleton organization against the exigencies of the future.

BUYING EQUIPMENT AT KHARTUM FOR OUR LONG TRAMP

Khartum is 1,000 miles south of Cairo. This was the frontier, the end of civilization. There was still equipment to buy!

The little boat pointed up the Nile was not due to sail for eight days. These were given over to a miscellaneous shopping expedition that took us into half the bazaars of Khartum, into private dwellings, into officers' quarters, into Arab godowns and up a multitude of alleys.

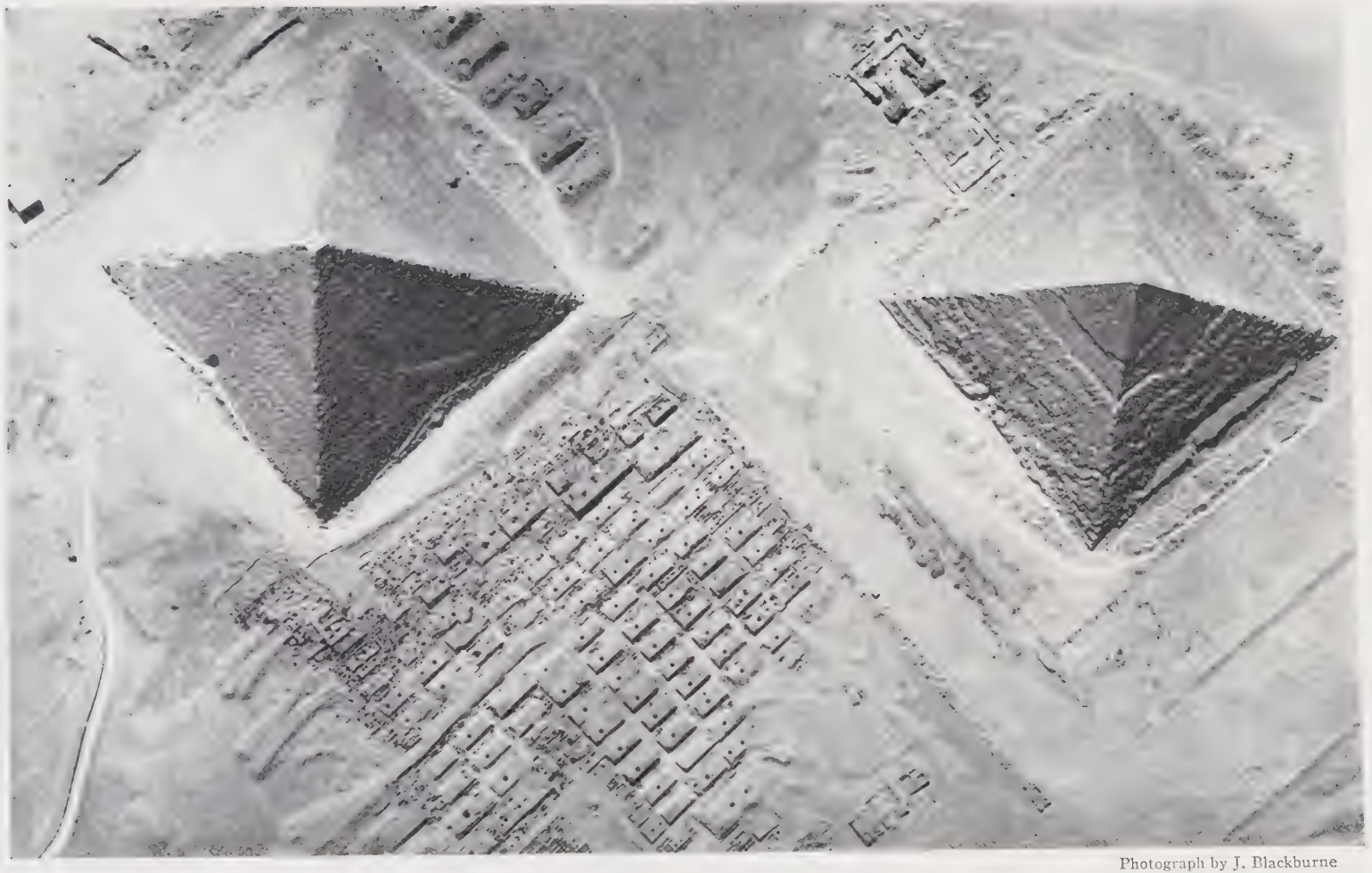
We needed a tent, camp beds, mosquito nets, mosquito boots, cooking utensils, rough clothing, medical stores, colored goggles, food supplies, and what not. Through our acquaintances of the train we met many white men. These good fellows constituted themselves a volunteer committee to find what we needed at the lowest possible prices. They interpreted for us, selected for us, and haggled for us.

Eventually we secured the necessary equipment and supplies. But we were unable to engage an English-speaking black boy who would venture with us up south.

The officials in Khartum advised us that the walk from Rejaf to Nimule was approximately 90 miles; there would be shelters provided by native chiefs along the way. They assured us that the *mamour* (a district official) at Rejaf undoubtedly would be able to outline the route and provide black carriers. They insisted that I carry some sort of firearm; so I purchased a high-caliber revolver.

Thus equipped, we were ready for the boat. But, inasmuch as the boat was not yet due to sail, there was a chance to explore Khartum and Omdurman.

Late afternoons we rode donkeys along the Nile, past the palace of the Governor-General, where Gordon was killed by the Mad Mahdi's men, toward the statue of



Photograph by J. Blackburne

THE PYRAMIDS SEEN FROM AN AIRPLANE

At the left is the Great Cheops Pyramid, one of the seven wonders of the ancient world. Beside the Second Pyramid can be seen skeleton outlines of the mortuary temple from which a causeway led down the plateau to the Nile. Remains of the limestone cap on the Second Pyramid can be clearly seen. Tombs of nobles, commanders, and engineers attached to the court stretch in rows between the pyramids. In one of the Mastaba tombs once lay the body of Khufu-onekh, chief architect of the Cheops Pyramid. Mastaba is Arabian for "bench," the term applied to the rock burial chambers because they resemble benches in modern Arabian bazaars.

Gordon sitting on a camel, looking out across the desert (see page 150).

The doctors at the Omdurman hospital, who are doing a wonderful work among the natives, invited us over for a day. Here were many pathetic sights. As we walked through the wards, we observed old black women, as gentle as the "mammies" of our own Southland, who insisted on kissing the hands of the doctors as they stopped to inquire about their progress.

A DRAMATIC PRAYER IN A HOSPITAL

One experience in this hospital very much impressed us. A physician, who was also a Doctor of Divinity, came into a convalescent ward and said: "My friends, such and such a black boy is to be operated on this morning, and he may die. I think we all ought to pray to God to let him live."

Christians, Mohammedans, and poor tribal blacks prayed aloud together, each in his own fashion, for the life of that black boy. Somehow, I felt that this was good missionary work.

After Omdurman we visited the tomb of the Mad Mahdi, which is dismantled. Kitchener feared it would become a shrine, for holy places are very dear to the Mohammedan mind. It is easy to establish a shrine; after a while it becomes holier and holier, and eventually may develop into a disturbance center. Even to-day, as the sun sets, the faithful creep inside the inclosure to pray at the empty tomb, and while we were there veiled women knelt in the dust outside, for it was the season of Ramadan.

The Gordon Hotel, where we stayed, faced on the public square, perhaps a hundred yards across. There was no grass. There was only sand. Step out into this square under the midday sun without one's pith helmet and one may have a sunstroke before he takes a hundred steps.

A short time before our arrival a Greek trader attempted to cross the square at noon on a rush errand, without his topee. He was stricken and died before he reached his destination.

While we were there the noontime temperature averaged about 115 degrees. The peculiar actinic rays of the sun played tricks with one's eyesight and smoked glasses were a necessity.

So frequent and so violent are the sandstorms in April and May that the Gordon Hotel has ceased trying to combat them. They blow through the window casings and scatter sand over the rooms and the corridors.

With evening came relief. A gentle breeze blew from the Nile and we sat on the earth terrace in front of the hotel from dinner until midnight, drinking lemon squashes and whiskeys-and-sodas. All the wit and wisdom gathered there; French, Germans, Swedes, Arabs, English, Syrians, Jews, Greeks, Italians, and two Americans fraternized. We exchanged banter and views. We were not very serious; one seldom was in that company and climate!

SOB AND BOOM OF TOM-TOMS IS HEARD ALL NIGHT

Off across the square, tom-toms beat perpetually and white figures of dervishes danced to the wild music. During Ramadan, every day is a fast and every night a festival.

A delegation went over to watch the show. Three musicians shuffled backward in a perpetual circle. They thrummed tom-toms—shallow hoops with skin stretched taut across. They sang; they chanted.

From time to time figures broke away from the tightly packed mob which inclosed the torches, and danced furiously, whirling after the manner of dervishes. Around and around they went, barefooted fanatics, leaping and gyrating in their long white robes and odd white turbans. One minute they struck a self-appreciative pose and held it; the next, they were in a frenzy again. They resembled nothing so much as chickens with their heads cut off, fluttering in the purposeless dance of death.

Each night we heard the sob and boom of the tom-toms lasting into the dawn.

We discovered the American Negro's love for watermelon is a hereditary influence. All these black people were excessively fond of melons. To the Sudanese they were food, drink, and refreshment, all combined.

FOUR "GEOGRAPHICS" ADDED TO EQUIPMENT

One morning we remembered that no seasoned traveler ever goes into Africa

Photograph by International

REFLECTING 5,000 YEARS OF HISTORY

The Pyramid of Cheops, across the river from Cairo, has a splendid setting—a plateau for a pedestal, the western sky for a "back drop," and the Nile to mirror its majesty. On the level mud plain, where turbaned Arabs now herd their flocks, once thrived for a few centuries a capital of Egypt. With the exception of a few scraps of masonry, the only remains of that city are the massive pyramids, tombs of its kings.

without a Book Shelf of Inspiring Literature to read between adventures. We had a family discussion. Porter suggested something light and something French, while I held out for "Pilgrim's Progress" and "Holy Living" and "Holy Dying," by Jeremy Taylor. We went to the bookstore and compromised on four ancient copies of the NATIONAL GEOGRAPHIC and a thumbed issue of "Vanity Fair."

With permits secured, equipment purchased and packed in boxes (weight, 60 pounds each), with special advice all written down, we were safely aboard that Sunday morning when the little boat shoved off up the White Nile toward Rejaf.

The ship's company included a Swede who had spent 12 years as a district governor in the Belgian Congo; an Australian who governed a back district for the English in the Sudan; an English major who had seen service in India and endured nine months in a German military prison; a Syrian doctor who had spent 17 years in the sleeping-sickness areas of the Sudan (a most unusual survival); two Egyptian doctors who were going into this sleeping-sickness area as the Syrian's

Photograph from Kodak (Egypt) Ltd.

A HARNESS MAKER'S SHOP IN EGYPT

This outfitter sells nothing but stable goods made of palm fiber. The variety of articles shows the importance in native life of the only tree species common along the Egyptian Nile. Palms also furnish building material, sugar, oil, wax, wine, dyeing materials, and resins.

assistants; an English engineer bound for Abyssinia; and two vagabond Americans, who were traveling overland toward Cape Town in the wrong season!

For three or four days after we left Khartum, there was still the desert for company. The heat was insufferable. There was no ice on board, and food was purchased daily at native villages. We lived on eggs, chickens, lamb, vegetables, melons, and tinned foods.

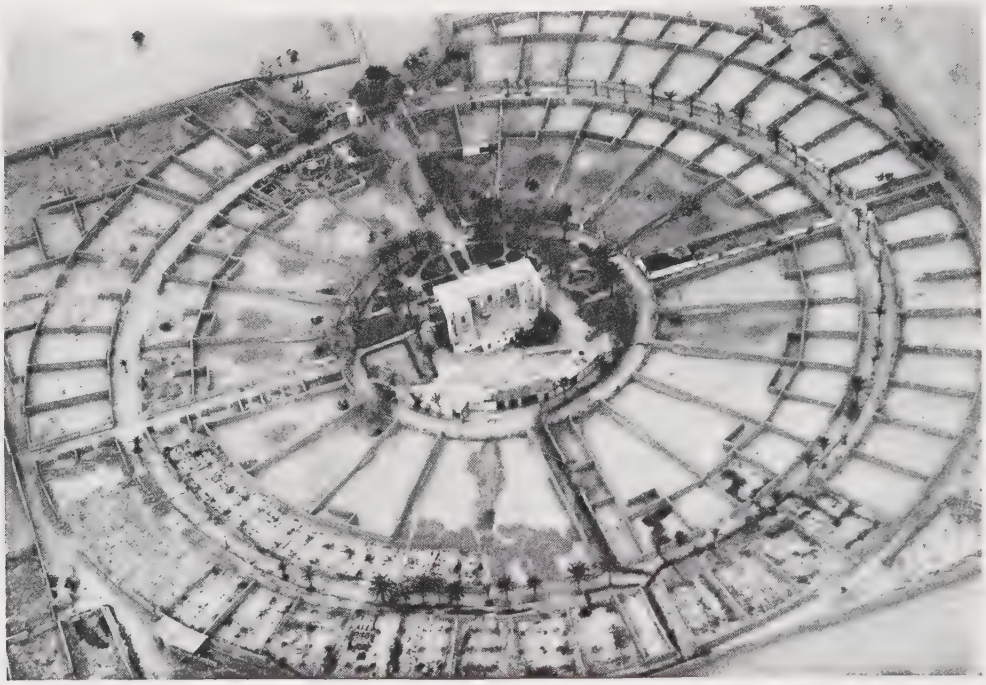
The desert behind us, we entered the Sudan proper. The land was fertile and level to the horizon. Thousands of cattle grazed along the shore.

About 160 miles up the river we passed Abba Island, where the Mad Mahdi once worked as a boatman.

NATIVES STAND LIKE CRANES ON ONE LEG

Soon the characteristics of the natives changed. So far, we had seen only Arabs and mixed breeds. Here we met Negroes and Negro-and-Arab half-castes. The Negroes were genuine savages; they wore feathers in their hair and rings in their noses.

Two interesting black tribes are the Shilluks, who live on the west bank of the Nile, and the Dinkas, who live on the east. Both average close to seven feet in height. They are as thin as the Nile



Photograph by J. Blackburne

AN OSTRICH FARM AT CAIRO FROM THE AIR

Careful segregation of ostriches during nesting time and division of the flocks as they mature require extensive pens. The birds are long-lived. Claims are made of ostriches 100 years old. Fashion, with a careless whim, decides for or against prosperity on the ostrich farms, most of which are located in South Africa.

cranes, and stand like cranes, on one leg, with the other leg drawn up under them!

The Shilluks wear two huge "Scotch tams" of matted hair, one on each pole of the head. This was our first introduction to the extraordinary coiffures of the male African. Some leave the hair its natural color, while others dye it a bright red with lime.

The Dinkas decorate their woolly pates with gay-colored feathers.

All carry spears and knives strapped to the back of the upper arm behind the elbow, where they are quickly accessible.

Most of them smear their bodies with ashes to keep off the mosquitoes. This makes them look like gray ghosts. They sleep in the ashes of their fires at night.

The men are the beauties; the women do the work.

Some of these dandies wear tight copper bracelets round their wrists until their hands grow numb and useless. They posed and displayed their deadened hands covered with rings and bracelets, which, we were told, their womenfolk greatly admire.

The women wear only a strip of dun-colored cotton. Many of them stood naked to the waist, neither embarrassed nor self-conscious.

One finds it easy to recognize the Negroes with a mixture of Arab blood. The eyes betray them. The Arabs have eyes of a peculiar and distinctive luster, moist and luminous, and shaded by long eyelashes. The dirtiest little Arab girl can perform tricks with her eyes that are astonishing. It was amusing to see those half-caste girls attempt to woo the white men with their eyes.

800 LANGUAGES AND DIALECTS ARE SPOKEN BY AFRICAN BLACKS

There are some 800 languages and dialects spoken among the more than a hundred million Negroes and negroids in Africa.

In many sections languages and customs change with each 50 miles.

These particular Nile blacks are shift-

less, vain, noisy, and warlike. Their villages are clusters of grass huts, like gigantic beehives.

These savages own fine herds of cattle and flocks of goats. They eat the sheep and the goats, but they use the cattle for currency. So many cows buy a wife. Wealth is counted thus. They drink the milk, but it is very unwise for a white man to do so, because of certain unpleasant native practices in milking.

After the first five days up the Nile we approached the big-game country. Hundreds of hippos splashed in the shallows. Whenever we negotiated a bend in the river we would see dozens of pink noses and piglike faces turned toward us. They would sink almost immediately; then rise and peek at us; then sink again, rise and wiggle the water out of their ears and eyes, and peek and sink once more. One frolicsome fellow hurled himself clear of the water and dived like a fish. His bulk considered, that was no mean feat of agility. Certainly, to shoot these inquisitive, fat animals cannot be called hunting.

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RAPID TRANSIT AT LUXOR

Water bucks and gazelles and antelopes spotted the landscape. There was an infinite variety of horned animals.

On every bank we saw crocodiles sunning themselves—lazy, deliberate fellows, grotesque survivors of a prehistoric age. They were twice as large as we anticipated, and when we encountered them farther inland, they stood up on really long legs and wiggled and wobbled away with considerable speed. When they were near the water, they slid in with scarcely a splash.

We saw storks and cranes, herons, hawks and eagles, and many varieties of ducks, pelicans, and scores of birds for which we had no name. All day long flights of birds were passing overhead and feathered congresses were talking it over on the shores.

A CARE-FREE LIFE LED BY THE NATIVES

The country so far was flat, level, and dotted with trees. This soil was black and rich and the natives lived easily. No one yet has devised a plan for making the native Africans work. They seem to wish for nothing that is not free and under their hands. They wear practically no clothing, live in grass and mud huts,

Photograph by Felix Shay

CALLING AT KING TUTANKHAMEN'S TOMB

The entrance to the 3,000-year-old vault of Egyptian treasure is to the left of the tent. Discovery of the ancient king's tomb, with its gorgeous burial furnishings intact, brought heavy tourist trade to the completed Cairo end of the Cape-to-Cairo Railroad. The Valley of the Kings, in which the tomb was found, is on the west bank of the river, across from Luxor, where visitors arrive after a 450-mile rail journey from Cairo.

and find amusement in having children, hunting, fishing, frolicking, singing, dancing, and decorating their bodies.

These natives have evolved a school of arts and decorations for the human body that excites wonder. The variations are multitudinous. They wear teeth and bone bracelets, metal anklets and nose rings, curious amulets and charms, and odd bits carved from ivory.

Meanwhile, the land and civilization languish.

The Swede said, "I had a black boy once, and he was a good boy. I took him with me when I was detailed elsewhere, but first I had to have his neck glands examined for sleeping sickness. I took him to the doctor's office and left him there while I went to the Governor's house. Just as I came back I met the boy running away as fast as he could toward the jungle. I shouted to him and he came to me.

"'What's the matter?' I asked.

"'Oh, Master, the doctor started to feel if I was tender. He was going to *eat* me!'"

The Syrian doctor showed us, under

glass, one of the tsetse flies, the bite of which causes sleeping sickness. It was a little larger than the ordinary house fly, its wings overlapping like the blades of scissors when the insect is at rest.

The first two nights Porter and I slept modestly in our cabin. We surrendered the mosquito room on the roof to our fellow passengers; but when we found ourselves unable to breathe below, because of the heat, we abandoned modesty and joined the other passengers outside.

I never saw so many or such a variety of insects. We observed two or three families of mosquitoes; white ants, black ants, red ants, and flying ants; spiders from the size of a pinhead to the size of a dollar; large green flies, cattle flies, horseflies—and flies; gnats and sand flies so small they easily passed through a mosquito net to burrow in one's flesh; dragon flies, big buzzers, airplane stingers, and darning needles on wings; gnats and ticks and a dozen varieties of grasshoppers!

They blew in from the marshes and covered the decks and us. We pulled our socks outside our trousers to fend off the curious ones. Porter wore riding boots and defied them.

At night the natives held a torch over a hole in the ground. The light attracted thousands of flying ants, which were scorched and dropped in. When the hole was filled the feast began. The natives ate them!

PASSING THROUGH THE SUDD REGION, HOME OF PAPYRUS

We passed into the Sudd, the high-grass country, whose swamps grow the papyrus grass from which was made the writing material of the ancient Egyptians. These papyrus growths once blocked the channel of the Nile and made navigation impossible. To this day great islands break away from the banks and temporarily obstruct the channel.

In this high grass we fell in with a herd of some twelve wild elephants, within 30 yards of us. Then we learned how fast an elephant can travel. When they saw the boat they lifted their trunks and started to amble off in leisurely fashion. Within a few minutes they were mere specks on the horizon.

Hunters dare not go after these big beasts in this region, for if wounded the elephant may charge, and when this occurs it is well to have solid footing or some substantial place of refuge.

We were three days passing through the Sudd.

One who thinks he has experienced mosquitoes should make the acquaintance of the multitudes on multitudes that swarm in these swamps.

Going up the Nile is an adventure in navigation, for there are numerous sand bars, and between trips they change from one side of the river to the other. Once a day, at least, we ran aground solidly, although our boat drew only four feet of water. We would churn the water back, go forward, turn left, turn right, and after so long a time the soft mud would be ironed out and we would be free to go forward again.

Once or twice a day we ran smack into the bank while attempting to negotiate a narrow turn. In this part of its course the Nile is extremely tortuous, and to hold the channel we kept to the extreme outside of each bend. There the water was deeper—perhaps.

When we reached a native village we simply plowed into the mud and put out a gangplank.

At various of these interior stations we lost our fellow passengers, one at a time. The English major went into a district which was a real killer, with all the fevers and plagues. The year he spends there counts double on his service record, so he will be retired that much sooner. If he lives, he wins. If he dies—well, Kismet!

One quickly becomes a fatalist in Africa.

A BIRD THAT PLAYS DENTIST TO A CROCODILE

We passed little hippos riding on their mothers' backs.

We saw that strangest of sights, a little bird, the ziczac, inside the open mouth of a crocodile, cleaning its teeth. We saw a crocodile catch a fish and grin, and while he grinned the fish jumped out.

On the Nile we met the rains blowing down from up country. They were extremely violent, so much so that the boat

Photograph by Gaddis and Scott

SOLDIERS IN THE VALLEY OF THE KINGS GUARDING TUTANKHAMEN'S TOMB

The entrance to the tomb of Rameses VI is below the lone tree on the hillside to the right. Behind the soldiers is Amenmeses' tomb. Next to the right is the vault of Rameses III. The water jars to the left mark the spot where Theodore M. Davis and his associates stopped work, and thereby missed the discovery of Tutankhamen's tomb by a few feet. Overhanging the débris-strewn royal graveyard is el Qorn, a natural pyramid. Ancient Egyptians liked to bury their dead in the west, where their Sun-god went to sleep, and therefore the Valley of the Kings, with its graves, and the Pyramids of Gizeh are on the west bank of the Nile.

was in perpetual danger of being overturned. Two or three years before, in the rains, one of these White Nile boats was blown over on its side and sunk. There were several fatalities. In consequence, whenever we saw a storm coming, the skipper put for the bank. Then the black sailors went over the side and anchored us to several trees.

Before and after these storms there were marvelous sky effects. The skies seem more expansive in this part of Africa than elsewhere in all the world. They convey an awesome impression of vastness. They were often smoky, sullen masses of threatening color, but we were entranced by the marvelous afterglow in the evening, after the sun went down.

Here we began taking a daily dose of five grains of quinine. A missionary on shore told us that he had taken five grains every day for 15 years, "and I'd not like to see that quantity all in one pile," he added.

A GOOD WIFE IN THE CONGO SELLS FOR 10 GARDEN HOES

The Swede started a story, which was interrupted by the appearance of 14 wild elephants on the near shore. They lifted their trunks and moved off. Elephants have a remarkable sense of smell, and some hunters maintain that when the wind is in the right direction they can detect the presence of man two miles away; but their eyesight is so poor that they can see him clearly at only 100 feet.

The Swede took up his story again:

"The Congo Pygmies kill elephants by creeping up on them. The Pygmies smell like animals, so there is no warning odor. When they reach the elephant they want, they quickly slash the beast's leg tendons with a sharp knife. Then the elephant finds himself unable to stand. He falls to the ground. That is the end of him."

This tale left us with an unpleasant mental picture of a little black man wriggling noiselessly through the grass with a knife in his teeth, perhaps toward our camp.

When the Syrian doctor left us he waved good-bye from the bank and shouted, "I will meet you three years from now in Paris."

These men are above despair.

We had some discussion as to how much a black wife was worth in cattle. One of the white men said, "Well, a chief's daughter will cost you about 50 cows; but that is excessive. The gentleman not only buys the lady; he buys her social standing as well. One should be able to buy a nice, plump young wife for not more than 10 cows."

The Swede protested: "In the Congo country one can get an A-1, all-wool young wife for 10 garden hoes."

We met savages on the river in tree-trunk canoes. They put ashore and stood and stared. The wash of our boat would have upset them, they knew. We also saw natives wading and "fishing" with spears.

Many of the grass huts were tiny beehive-shaped structures, not large enough for a man to stand upright inside. They were surrounded by stockades of yellow reeds.

One night, just as the dark descended on us, the boat stopped at a clearing. We were in a malarial country. The damp rose from the ground like a mist. The mosquitoes swarmed. We went ashore for exercise, but the body odor of the multitude of blacks was sickening and drove us back on to the boat.

At that point an English missionary came alongside in a big war canoe manned by 20 native paddlers. He was a splendid type of man, who had spent more than a dozen years among the blacks in Africa. The canoe he had brought overland from the Congo on wheels. There are no trees in the Sudan of sufficient size to make these great boats.

Perhaps the transportation overland of this canoe took a whole year. With it and his native paddlers he traveled the principal rivers and the side streams and visited the inland blacks. He ate native food and slept when and where he might.

Only a very exceptional man, inspired by the work he was doing, could survive this kind of life.

This missionary attempts to teach the natives peace, morality, the respect for property rights, personal cleanliness, agriculture, and, just incidentally, religion.

Toward the end of the sixteenth day we nosed again into the mud bank. That was Rejaf!

Rejaf rests on a hill, a typical Nile River station.

The mamour, the official in charge, was an Egyptian.

He lined up 100 black boys and permitted us to select 22. No English-speaking boy was available, no cook obtainable, and no boy present had ever attempted to cook for a white man.

These boys could carry loads. They were willing to go approximately half the distance to Nimule (see map, page 128). That was enough for us. At 3 o'clock the second day we set out.

The carriers were to walk with us 57 miles, to the limits of their district. They were not permitted to enter the next district, as it was a sleeping-sickness area. At the border we were supposed to engage another safari to take us through to Nimule.

The mamour marked and mapped the so-called resthouses to the boundary of his district. Beyond that he had no information.

A traveler must "go it blind" and trust to luck in Africa.

"DEAD-EYE DICK" IS THE CENTER OF THE FIRST DISTURBANCE

On the far side of the Nile we ran into our first bit of trouble. Among our porters we had selected a one-eyed man for luck. Getting out of the barge, "Dead-eye Dick" had a disagreement with one of the younger boys as to who owned what. He slapped the boy's face; the slap stung. Before the boy had time to remember his manners he struck "Dead-eye" in his good eye and knocked him into the river.

Immediately an uproar!

A couple of sprightly colored ladies standing by laughed at "Dead-eye," which rather complicated the situation.

These ladies painted their bodies with a kind of red, oily clay, which entirely changed their appearance and made them look like some one else. Their apparel consisted of a little fringe in front and a "horse-hair" tail behind. They were not very tall, but well developed.

The safari set out boldly along the Nile.

Stark-naked muscular blacks stood in the fields and saluted us. A few had skins around their waists and carried spears. The women were stocky, well developed, and much fatter than the men.

These savages go about completely exposed to weather and sun. The human form divine is a creation of civilized man. Savage people may have strong, sturdy bodies, but rarely beautiful bodies, according to our standards. All of them had slightly bowed legs.

One dropped part of his equipment; he picked it up with his foot, using it as a hand. Their feet are spread, their toes prehensile.

NEW JERSEY SCENERY IN CENTRAL AFRICA

About three miles from where we crossed the Nile, we were obliged to ford another river, waist-deep. There was a discussion as to whether we should disrobe. We discovered that civilization rested heavily on us; we waded-in in our clothes. But for an hour afterward we attempted to decide, "What is propriety in an African jungle?"

Just beyond this river was a resthouse. While the boys ate peanuts, we loitered in the shade. Peanuts were the food staple of these carriers. They took with them peanuts and durra flour and nothing else.

After fifteen minutes' rest, we set out for Shoga, a village seven miles away. We planned to complete 10 miles before we slept. We walked in the cool of the afternoon, through beautiful country.

The native villages seemed prosperous. The blacks either greeted us curiously or else turned away and ignored us; the little children shrieked and fled to their mothers at sight of us. The countryside was green and verdant. There were many fine trees scattered on the landscape. We expected a desolate wilderness or tropical jungle; we encountered here a region similar in appearance to suburban New York or New Jersey.

Occasionally we met blacks grubbing weeds out of the main path with their pick-hoes. In this way they pay their taxes.

The sunshine was mild and invigorating after our escape from the desert and Khartum. A cool breeze blew. Thousands of birds of infinite breed and varied plumage flew about. We were amazed at their fearlessness. The only disappoint-

Photograph by Gaddis and Seif

FREIGHT BARGES OF THE NILE AT LUXOR

Native dhows with perilously high lateen sails help bring out the products of the Nile Valley. To the Sudan the world looks for the best qualities of one obscure raw material, gum arabic. Harvesting good grades of gum arabic from a species of acacia depends on a hot, rainless season, and this the Sudan supplies. This gum serves in medicine, mucilage, and photography. The world is beginning to look to the Sudan for cotton, too.

ment was an absence of wild flowers; but there were flowering trees.

We barely managed to keep up with the safari.

Much to our surprise, they took short steps. One presupposed that long-distance walkers adopted a long, swinging stride, but not these blacks.

MEN OF THE SAFARI WERE DESCENDED FROM CANNIBALS

Those who laugh at the big feet of the American Negro should see the work such feet are educated and adapted to do. They have the natural feet, we the unnatural. Long before the first 10 miles were finished, our shoe-wrecked "civilized" feet were crying "enough."

These men of our safari belonged to the Bari tribe, of the region of Rejaf. Some years ago a cannibal tribe swooped down on the then peaceable Bari, killed the men, and ate most of the young children. The Bari women the cannibals took as their own and settled down to lead a domestic life on the spot.

Therefore the Bari are a considerably mixed tribe.

We had several gentlemen in our safari who, even at this late date, looked as

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CONTROLLING THE LIFE OF EGYPT AT ASWAN

These gigantic jets of water are spurting through sluices 6½ feet wide and 28 feet high, in the Aswan Dam. Before the construction of this dam the Nile was a curse as well as a blessing. The terrific floods brought fertile mud, but by March the valley parched for lack of water. Aswan, with its mile and a quarter of masonry, 131 feet above the foundations, is one of the world's longest dams. Between July and November wide-open sluices let the muddy water through, but during the winter a reservoir 185 miles long husbands supplies for the dry months.

though they would not shrink at a human shinbone.

There was native warfare in Rejaf as late as 1910.

We had men of all ages in our safari; some as young as 16; one at least 60. Four of the youngest ones were reserved as personal boys, two to put up the camp beds and wait on table; two to make the fires and cook (?).

One of my personal boys had his hair cut and shaved in scrolls; the other had a topknot of wool which decorated his crown. Porter gave each of her boys a string of bright glass beads to wear, which made them easy to identify.

When we reached Shoga it was dark. There was an empty hut, and we proceeded to make camp. We had never erected our camp equipment before. Certainly the boys did not know how to do it. In the intense darkness one could not see these black boys two feet away. Detached, spooky hands were always reaching out of the dark to help with a task. For amateurs to make camp in an unknown land—put up beds, mosquito nets, tables and chairs, and cook a meal under such conditions—was no small task.

The only real mistake we made was to place our beds on the inside of the hollow square facing our carriers. Placed on the outside of the square, there was more privacy and much less noise. We made this mistake but once.

These resthouses are set down in the wilderness, apparently adjacent to nothing but water. Sometimes there would be a native village concealed on the far slope of a near-by hill, but unless one looked twice it was almost impossible to discern them.

SAVAGE AFRICA CELEBRATES THE MOON

The resthouses are surrounded by stockades of saplings to keep out prowling animals. Inside the ground is bare. The hut shelters are made of mud and straw, with hard dirt floors. Sometimes there is a mud fireplace for cooking; sometimes not.

At Shoga we saw no native village, but soon heard one. The moon came up, the first clear and cloudless night for weeks. The rains had passed north. Shortly after we turned in, we heard the thrum of a tom-tom calling quietly, insistently. A fire was reflected against the sky. Apparently there were to be "doings."

Our carriers became very restless. The moon was affecting them, too. Dark forms walked from group to group. There were sibilant whispers and muttered conversations.

Then the tom-tom began to sob and moan. The noise seemed to come from immediately outside the stockade, but the glare of the fire assured us it was 100 yards off. Nevertheless, I rolled on my side, felt for my revolver, and placed it under my pillow. Dead tired and aching for sleep, we lay wide awake and waited.

The fire mounted higher. The whole sky grew red.

The tom-toms beat a wild and furious quickstep. Suddenly we heard a chorus of a thousand voices! Such singing! Those who have listened to plantation songs by a large group of American Negroes will have a slight conception of the glorious harmony and resonance of these voices. Men and women sang together, and a fairy flood of children's voices floated in at intervals, followed by an ecstatic cheering.

A CIRCLING MULTITUDE DANCES ALL NIGHT

From 8 o'clock, when the drums first called them together, till the dim of the moon, they sang, they danced, they beat their tom-toms.

One song they sang was as fast as "Jingle Bells," with almost as many parts as "Three Blind Mice." It ended with a mighty and sustained crescendo, like the locomotive cheer at an American football game. When the last echo of this cheering died out, we could still hear the chink-chink, chink-chink, of the metal ornaments which the women wore around their arms and ankles. . . .

Long after midnight we deserted our beds and walked into the clearing behind the resthouse and watched the multitude of dark forms circling the fire. Round and round they went, until our eyes grew weary from watching them. Perhaps more adventuresome spirits would have walked across the distance and intruded on the show; but we were new to the premises and still a little fearful about savage Africa.

Photograph by Felix Shay

BENEATH "CHINESE" GORDON'S STATUE AT KHARTUM

General Gordon earned his sobriquet by his vigorous action in putting down the fanatical Taiping revolt in 1863, and he won immortal fame by his defense of Khartum, capital of the Sudan, against the Mad Mahdi's tribes in 1884-5. With one other British officer, he was isolated in Khartum while superintending the evacuation of Egyptian civil employees. Organizing a defense, he held out for nearly a year; but the city fell and its intrepid defender was killed two days before the rescuing force arrived.

Before we were decently asleep the black carriers were up and stirring. They like to travel in the cool of the morning. Travel between 10 a. m. and 3 p. m., in the hot sun, means disgruntled boys.

While we were at breakfast the last of the revelers were still stroking the tom-tom and trying to sing something that might have been "Auld Lang Syne." We were under way by 5 a. m.

The second day we were to walk to Pettia Liminda, a distance of eight miles,

Photograph by Porter Shay

THE AUTHOR'S SAFARI THREADING THE TRAIL THROUGH BROKEN COUNTRY IN THE SUDAN

take lunch and rest; then walk to Pettia Logar, a distance of six miles, for supper and a sleep. When one walks in Africa he learns that distances are essentially approximate!

On the path that day we met few blacks. Some of the women wore winding, coffee-colored skin sheets. With heads shaved, they resembled Buddhist priests.

The country we passed through was similar to the deserted farm lands of New England. The land was uneven, hilly, rocky. Small trees dotted the landscape. Often we would come on what seemed an overgrown and neglected orchard, though, of course, it was not.

Apparently there were no tropical growths, as we recognize them. The country was such as one would find in the North Temperate Zone. We were five days toward Nimule before we saw our first palm tree.

The weather was cool, except at midday. Often there was a breeze. We were quite comfortable walking and enjoyed it very much.

We still had the rag end of the rains with us, but occasional showers fortunately found us under cover.

Photograph by Felix Shay

SUDAN NATIVES WITH A TRACE OF ARAB BLOOD

The Nile is a racial boundary in northeast Africa. West of the river tribes in which Arab blood is strong predominate. East of the Nile are the Hamitic tribes, who in migrations south have furnished Africa with some of the fiercest and sturdiest native stock on the continent.

The black boys who walked with us were paid 10 cents a day. They carried 60 pounds on their heads and averaged 17½ miles a day. They supplied their own food, consisting of soggy, doughy cakes of durra flour, and peanuts, varied only when we volunteered to buy them chickens or goats.

For each day's march we were obliged to assign the loads specifically, else the large boys would take the lighter loads and give the smaller boys the heavier.

We took along a surplus of carriers, so there was a relief for the boys who were too heavily burdened. In the early morning we indulged a lively interest in life; we conversed, we philosophized, we joked. After the first 10 miles silence reigned.

Soon the country was empty of natives.

We passed by a rocky ridge off to our right. There was the sound of a rending of limbs. Giant baboons were venting their displeasure on the trees. These creatures, gray in color, were about four feet high and weighed approximately 100 pounds each. They barked at us like dogs—a hard, sharp bark. While watch-

Photograph by Felix Shay

MRS. SHAY AND TWO SUDANESE CARRYING CUDGELS

"One day we were joined on the march by two savage women. One was short and pudgy; one tall and angular, with a new baby strapped to her back under a half-gourd shell. Each wore a skimpy fringe about the waist. We found that the gift most appreciated by these women was a box of matches" (see page 154).

ing us, they would swing from tree to tree, miss their objective, and go crashing down among the limbs. There were at least 100 in the troupe.

BANDAGES FOR BLISTERED FEET

When we reached Pettia Liminda we bathed and changed into fresh clothes. We applied adhesive tape to our blistered feet, which were unaccustomed to tramping, as we had spent too much time on shipboard the preceding year. We dined and lolled in camp armchairs. A delightful calm came over us. We had walked ourselves into a state of complete relaxation.

A little blackbird alighted on the palings of the stockade and sang us a super-Galli-Curci aria, and I am sure we were not an unappreciative audience.

The mamour in Rejaf had advised us that the launch would sail south from Nimule six days later, at noon. Therefore we had just six days to walk 90 miles (which proved to be 105 miles). We accomplished this distance with half

Photograph by Porter Shay

THE AUTHOR POSES WITH A SIXTEEN-YEAR-OLD GIRL OF THE SUDAN

The conical wicker-work structure is used as a granary (see also illustration on page 184). Mrs. Shay, who made the photograph, was an object of deep interest to the native women.

an hour to spare. This required that on certain days we cover as much as 20 miles. Such days we were forced to walk into the noonday heat, which is not sport in the Sudan.

NATIVE WOMEN DELIGHTED WITH GIFTS OF MATCHES

In "Donovan Pasha" Sir Gilbert Parker writes: "In the Sudan three hours' march will usually draw off the froth of a man's cheerfulness." Some days we marched for eight hours, and at the end of the journey cheerfulness was not in us.

One day we were joined on the march by two savage women. One was short and pudgy; one tall and angular, with a new baby strapped to her back under a half-gourd shell. Each wore a skimpy fringe about the waist. We offered them cigarettes, but they made a mess of them; they were accustomed to pipes. We found that the most appreciated small gift to these women was a box of matches.

Our daily walks were from native village to native village. Until one reached a village (or water), he must continue walking.

Photograph by Vittorio Sella

A UGANDA NATIVE CARRYING MILK

Milk has a very definite connection with social position in Uganda. The dominant class is a pastoral people; the serf class grows crops. The Bahima, or governing caste, rigidly adheres to a diet of milk varied now and then with beef, a custom which is believed to be a relic of life on the plains before the invasion of the south. The milk carrier is a typical Bahima, tall and thin, but having a well-balanced physique. Missionary efforts have prospered in Uganda and thousands of natives have accepted Christianity. The white tunic is usually the badge of a Christian in that protectorate.

Photograph by F. J. Koch

A STATELY DAUGHTER OF THE SWAHILI TRIBE

The aristocratic bearing of the Swahili women has its source in the lowly task of bearing burdens. The Swahili are mixtures of Arab and Negro and have given Africa a widely used language, Swahili, a patois of Bantu and Arabic. The Swahili who live in the Zanzibar district are much used as porters for expeditions to the interior, and with them has gone their language.

We now found no difficulty in keeping up with our black boys. In fact, we often led them. Most of the time we followed a fifteen-inch path through broken country. Occasionally the path widened out near a village, where the natives were at work with their pick-hoes. But the natives, in paying their taxes in this fashion, selected the easiest places in the road to grub out the weeds. Where the going is difficult, the native never pays taxes.

We were obliged to ford five or six rivers in this walk of 105 miles Through most of them we waded up to our waists, or to our armpits, and defied the crocodiles. After a couple of wettings, Porter elected to ride across the rivers on the shoulders of one of the sturdy blacks. Once they attempted to carry me, but they nearly dropped their 175-pound burden into the stream; so I decided thenceforth to wade.

ENTERING A LAND OF SLEEPING SICKNESS

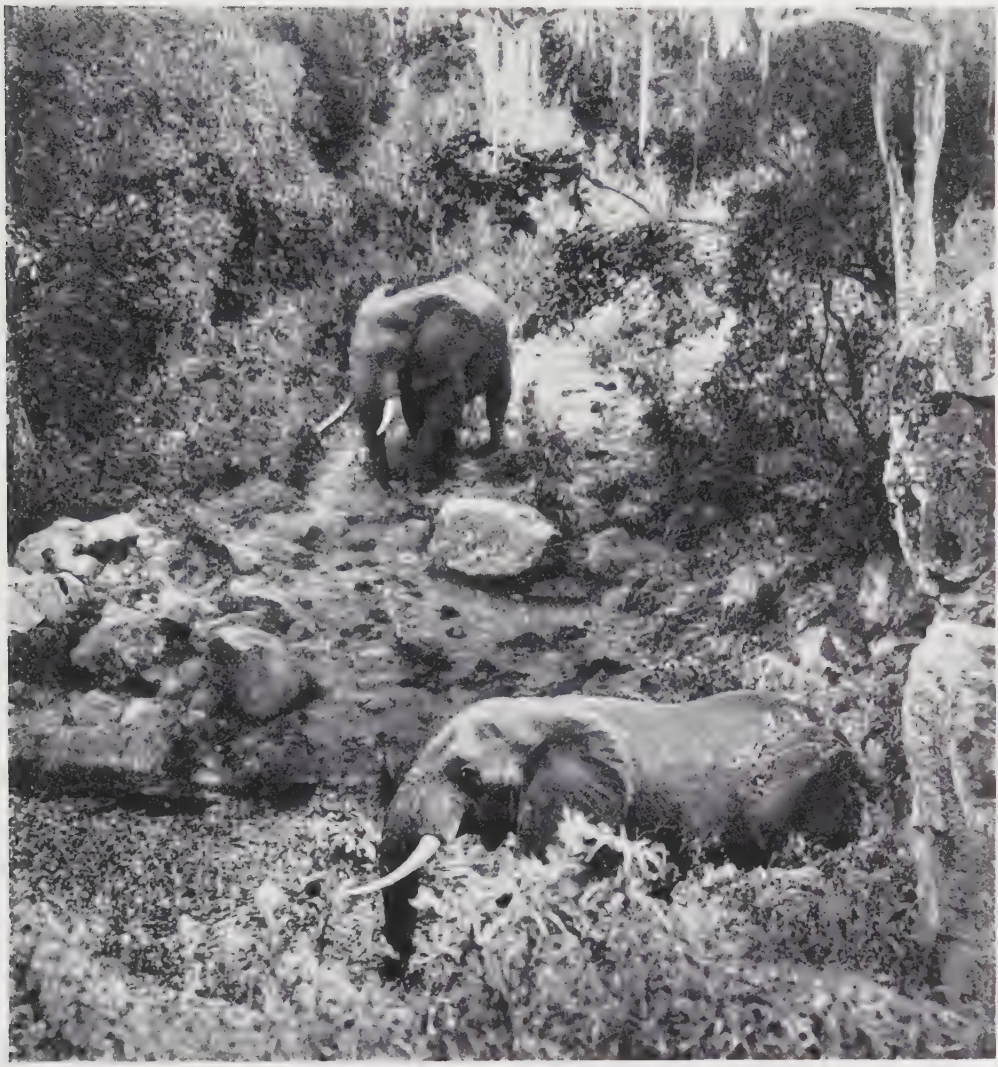
One day we reached Goombri, which was the frontier of the sleeping-sickness area. There we paid off our first safari of boys and negotiated in sign language for a new safari at a near-by native village.

The new carriers reported promptly at 6 o'clock the next morning. We were very glad to see them, as our first corps of boys had gone back home, and it was no pleasant sensation to be left alone in the middle of Africa.

The new boys were of the Madi tribe. They were more savage, more serious-minded, and not so frivolous or gay as the Bari crowd; but they were better set up physically, stronger, and went about their work in a more businesslike fashion.

We had picked up a few words of the Bari language on the trail. The problem then was to learn the language of the Madi. Meanwhile we used a sign language. They said "Ummmmmm" and "Unnnnnn," acquiescing perpetually, as one conversed with them.

All of these Madis looked very much



Photograph by Martin Johnson

TUSKERS SHOULDER-DEEP IN JUNGLE

The African elephant grows larger than the Indian elephant and is distinguished from his Asian cousin particularly by huge tusks and ears. Tusks serve not only as weapons, but also for uprooting trees the elephant wants for forage.

alike. They had shaved heads, leaving a single topknot, and had filed their teeth to sharp points. Many of them were pock-marked. They looked very ferocious, but they were well behaved in our company.

These savage boys, just out of the jungle, averaged very much as their civilized brothers average. Some were reliable; some were not. Some were ambitious, others lazy. Some had character; others obviously none. Here is a splendid opportunity for a sociologist to make a study of life in the raw.

The new boys were much interested in our bottles of lime juice. Evidently they thought it was white man's whiskey. To prevent them from stealing it, we evolved the plan of letting one taste it. We poured some in the hollow of a boy's hand. First, of course, I told him he would not like it, but he assured me he would. He gulped it down in one swallow. I have never seen anything funnier

Photograph by Vittorio Sella

PORTERS CARRYING CONFISCATED ELEPHANT TUSKS IN UGANDA

So great is the demand for ivory that colonial governments have stepped in to prevent the African elephant from disappearing entirely. A license to shoot one elephant in the Belgian Congo now costs $200. The British Museum in London has one of the biggest African elephant tusks on record; it measures 10 feet 2 inches in length, 24 inches in circumference at the big end, and weighs 226½ pounds.

than his face after that swallow. His companions laughed and shouted in glee. "Lemon," he told them, and again they laughed. After that the bottles were safe.

In camp they were as curious as children. Every empty tin can was instantly taken as a water cup. Every empty lime-juice bottle was spoken for in advance.

The native crops in this territory are few and small, consisting chiefly of durra flour, sweet potatoes, and peanuts. The water that was brought to us was foul and disagreeable, yet there were no fruits or melons for relief.

A conference with these boys to determine distances provided an amusing adventure, because a watch meant nothing to them and a "mile" meant less. They indicated distances with a broad, generous and inaccurate sweep of the arm. Then the inquirer knew as much as he did before he asked.

There was nothing to do but keep plugging onward until we reached a resthouse.

ASSEMBLING FOR A BIG DANCE

One night we ran into a wonderful dance. The guests headed for the place of assembly hastened by us for several hours before we reached it.

This was at a resthouse called Buna Karaffi.

The women of this section were slender,

Photograph by Vittorio Sella

HAYCOCK HUTS IN UGANDA

Broad acres of growing crops have small attraction for Uganda gentry. A thatched hut and a garden plot of maize, sweet potatoes, or peanuts, are enough for the day's needs. Only a small circle of land about a village is cultivated. When it ceases to be productive a new patch of brush is cut and burned. Corn, sweet potatoes, and peanuts are familiar foods, but the favorite in Uganda is the bananalike plantain.

Photograph by Vittorio Sella

PORTERS DANCING IN CENTRAL AFRICA

with fine physiques. Dozens of girls passed us, hurrying onward to the party, their bodies artistically clothed with oily red clay, their hair arranged in matted masses, shaped up like glistening red chrysanthemums. Most of them wore narrow belts of colored beads. They amused themselves at our expense by whistling shrilly from unseen covers, making the forest seem full of artificial birds.

They had bright, intelligent eyes and clean, white teeth, and were really rather pretty.

Dapper savages passed by, wearing feather crowns of brilliant colors. With legs painted white to the knees and arms and shoulders painted white, they presented a terrifying aspect to the casual observer, if one did not see the comedy in it.

These important dances are given immediately following the rains, preferably on the first moonlight night.

Once in two hours we gave the boys a 10-minutes rest and passed our cheap cigarettes among them, which they greatly appreciated. These natives were communists; each took one long puff and handed the cigarette to the next man.

A little later on the road we passed several groups of women, old and young, who had holes bored in their under lips and wore pendants of crystal or glass in them. We met five pleasant middle-aged women and had a very nice chat in sign language with them; then gave each a box of matches when we said good-bye.

The character of the country changed from hour to hour. It was broken, thickly wooded, and not what one would call tropical. There were stones galore and rocky ledges and ridges. We climbed up and down. Several times we crossed ravines on hand-woven basketlike bridges.

Toward the end of the sixth day out, which actually was five and one-half days in elapsed time, we arrived at Usswa, the last resthouse before Nimule.

A mile or so away was a ridge of hills. We arbitrarily determined that beyond those hills flowed the Nile. Because we were out of cigarettes and lime juice, we endeavored to persuade one of our boys to walk into Nimule and buy a supply for us, while we in turn would wait until the next morning for our tramp into town. But the boy gesticulated and emphasized that such was not possible.

Being fatalists, we took his word for it. Well we did!

Next morning we started late, about 8 o'clock, thinking that Nimule was only a couple of miles away. We discovered that it was 11 miles distant. We walked those 11 miles in three and one-half hours, and limped in half an hour before the boat was scheduled to sail up the Nile, only to learn that it was two days late!

Photograph by Felix Shay

HIS FIRST MIRROR: PORTER'S BOY SEEING HIMSELF AS OTHERS SEE HIM

This native's trousers represent one phase of the rapidly changing African customs. The reign of clothes is coming with civilization, but nudity is still proper with some tribes. Good bark cloth is made in many places and is sometimes used for undergarments to go with cotton trousers. A Grecian effect is obtained unconsciously by some dandies who knot a piece of white calico on the shoulder, letting it fall gracefully like a toga (see page 155).

NIMULE, HEADQUARTERS FOR SLEEPING-SICKNESS VICTIMS

Nimule, a Nile village, is the headquarters of a sleeping-sickness area. The detention camp contained several hundred afflicted blacks at the time of our visit.

The superficial aspect of a sleeping-sickness victim suggests that he might be suffering from a combination of tuberculosis and leprosy. It is a horrible disease. The tsetse fly is a carrier, not a breeder, of it. So far, there is no proved cure for sleeping sickness, although German scientists are hopeful that they have found a panacea in "Bayer 205."

White men are not immune. When one is bitten by an infected tsetse fly, the penalty is almost certain death.

A Syrian doctor at Nimule, a kind and generous host, took the trouble to warn us that the tsetse lives chiefly in low bush country, where shade is plentiful. He suggested that in this area we march in the dark, before dawn. The flies are not active until the sun rises.

There were three white men in Nimule while we were there—the Syrian doctor, an Italian engineer who was measuring the flow of the Nile, and a Serbian count, who was adventuring upcountry and whose route to Lake Victoria paralleled our own.

The first night in Nimule we had an adventure which we shall long remember. The sleeping-sickness camp of the blacks, located something more than 100 yards from our resthouse, was raided by three

lions. The roars of the beasts were terrifying, to say the least. The blacks beat drums and lighted fires to scare them off.

The white men who were dining with us in front of the resthouse excitedly demanded my "gun." The only gun I carried was the army revolver, securely packed away. ("Well, that's a —— of a way to travel through Africa!") Finally we found it and fired several shots into the air, which apparently frightened off the intruders. The next morning we found their spoor within fifty yards of the resthouse.

When we have forgotten the details of this record, when Africa is only a blur in our mind's eye, at night we shall hear the roars of those lions at Nimule. Those terrifying, coughing, choking, threatening, insolent, earth-shaking roars. We heard them again many times in Africa, but that first time made an indelible impression.

To sleep in a resthouse without windows or doors, with lions a few yards away, rather invited insomnia.

A WILD DANCE FOR THE VISITORS

We were just about exhausted when we arrived in Nimule, so that the two days' rest, with nothing to do but visit around, we found very pleasant.

The resthouse here was in very bad repair, but it was situated on a hill overlooking the Nile, and a friendly breeze played around it day and night.

The second night the natives gave a dance in our honor in the public square. The sky was black with storm clouds passing down the Nile. There was a lurid central fire—and more fire to warm the tom-toms. An angular, grotesque figure in a crown made of red and green feathers stroked and caressed and pounded and belabored with a full-arm flap-wing motion the three drums, each of which spoke in its own key. He wore a bit of skin around his waist, feather bands around his arms and his ankles. His feet and upper arms were painted white and a wild fanaticism lighted his eyes.

The government permits these natives to dance only once a week; it excites them too much. When a native gets excited he makes mischief.

A wide-flung circle of black bucks started the movement. They made a terrible din, beating gourds, horns, pieces of hardwood, singing, shouting, and chanting in unison. As they sang they danced furiously, stiff-legged, with feet wide apart. They shook and shimmied their shoulders and spasmodically moved their arms. They were naked except for breechclouts, but their bodies and legs were painted in patterns. They had feathers in their hair. They would sing and dance a verse, then "E-Yah! Boola-Boola! Wiggle-Wiggle! Walk."

Around and around they circled at high speed and with a roaring hubbub.

These wild men of Nimule had a repertoire. The leader shouted; that dance ended and another distinctive number began.

Now we were to see something! Women had joined the dancers. All were innocent of apparel except for the usual little fringe.

They gyrated in front of the men—extraordinary dancers, their glossy bodies performing contortions that would start a vice crusade in any civilized city; yet in this atmosphere, among these savages, it all seemed right, proper, and respectable.

One woman wore a half gourd on her back. Under that shell, tightly strapped to her body, was a four weeks' old baby. We had a look at it. It was sound asleep in that inferno of noise!

The dance increased in violence, though it was difficult to imagine how there could be more noise or more action.

One woman in particular made her body gyrate and squirm, vibrate and quiver, until one felt impelled to break his neighbor's hat and let the nebular hypothesis prove itself.

We wondered whether the "savage" inside each of us is really dead.

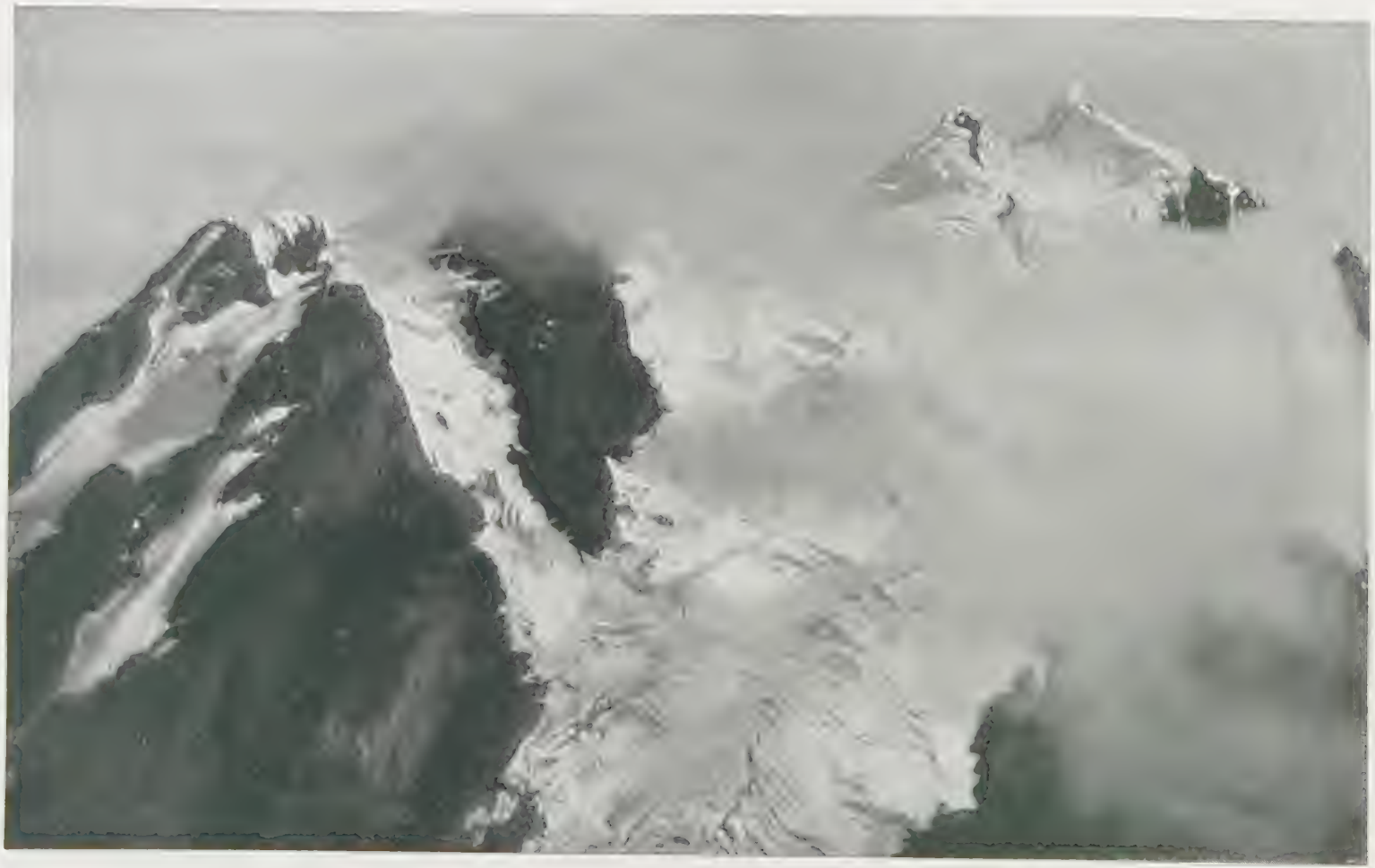
A DANCER "YIPS" WHEN SHE IS PLEASED WITH HERSELF

A Sudanese official who was there told us that when pleased we should advance and lift the performer's arm and hold it aloft, after the Roman style. Porter tried her luck. She stepped in and held aloft the arm of the woman who seemed to know herself so intimately.

Photograph by Vittorio Sella

A TRAIL UNDER THE CANOPY OF A UGANDA FOREST

The Uganda Protectorate is rich in timbers of both the tropical and temperate zones. Through many of its dense woods it is impossible for the white man to penetrate without a pioneering party to cut a way. Paths such as that shown in the illustration are maintained by natives, who pay their taxes to the colonial government by waging a perpetual warfare on the encroaching jungle (see text, page 146).



Photograph by Vittorio Sella

MT. STANLEY OF THE RUWENZORI RANGE

Old geographers filled the center of unknown Africa with high mountains. Modern exploration has shown that Africa is devoid of ranges like the Rockies, the Alps, or the Himalayas. The Ruwenzori chain, about 50 miles long and 25 miles wide, is the only very high mountainous formation on the continent. Mt. Stanley, named for the explorer, is the central massif of the range. Three of its peaks are here shown: Savoia is veiled by a cloud, Alexandra holds the center, and Margherita, at the right, attains an elevation of 16,815 feet.

Photograph by Vittorio Sella

THE ETERNAL SNOWS OF RUWENZORI, ASTRIDE THE EQUATOR, IN AFRICA

The muddy Nile has little resemblance to sparkling mountain streams, yet the snows of Ruwenzori feed its upper branch. The Ruwenzori range seems to be Nature's experiment to see what will happen when a snow-capped mountain block is set down on the Equator under the sun's concentrated fire. Its permanent cap of snow, although close beside the Cape-to-Cairo route, is rarely seen by travelers. By contrast are the rain clouds around Ruwenzori that the fact that it was snow-crested was not known until years after its existence was established.

Photograph by W. D. Young

A WAKAMBA FAMILY AT HOME IN KENYA COLONY

Huts of Negro tribes in Africa are practically always of beehive shape, but they differ in details. An African residence inside is usually a collection of posts. These serve not only as roof supports, but also as uprights for partitions. In large huts natives often curtain off with bark cloth sections for a goat stable and other divisions for sleeping quarters. The center may be devoted to one or two fireplaces.

Photograph by Vittorio Sella

A WRESTLING MATCH BETWEEN UGANDA PORTERS

Probably the first thing the African native looks to the outside world for, if he looks at all, is cotton clothes. Almost anything is acceptable—white men's cast-offs, nightdresses, or just a few yards of goods slung on one shoulder like a skin. The women generally prefer the darker-colored calicoes. Cotton goods from the United States, England, India, and Japan reach native traders.

© John Graudenz

AN AFRICAN LION IN CAPTIVITY POSES FOR HIS PORTRAIT

© Arthur H. Fisher

CONSORT OF THE KING OF BEASTS

Photograph by Vittorio Sella

RIPON FALLS: THE GOAL OF MORE THAN 2,000 YEARS' SEARCH

The northern end of the Nile, the falls at the outlet of Lake Victoria, was discovered in 1862 by J. H. Speke and J. A. Grant, two British explorers. The ultimate source of the Nile is the headwaters of the Kagera River, southwest of the lake, but Ripon Falls are generally considered the beginning of the White Nile, main branch of the mighty river. Egypt, pushing south, always wondered about the source of the Nile, the most important factor in its national life. Ptolemy, the celebrated astronomer, mathematician and geographer of the second century of the Christian Era, made a good guess, but tropical forests and great floating islands of vegetation peculiar to the upper Nile postponed discovery. The river, whose lower valley was a cradle of civilization, was one of the last of the world's great rivers to surrender the secret of its headwaters.

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MOUNTAINS OF DÉBRIS FROM A GOLD MINE IN THE RAND, SOUTH AFRICA

Gold mining in the Union of South Africa is one of the chief sources of the country's wealth. The famous Rand of the Transvaal is a ridge of granite outcrop near Johannesburg extending east and west nearly 80 miles. Most of the other famous gold workings of the world are in quartz formations or in stream beds; but on the Rand gold occurs in sediment laid down on uplifted granite base block. The success of the Rand is not due to very rich deposits, but to regular deposits scientifically worked. Note the human figures silhouetted against the skyline.

THE CHASM AND LIVINGSTONE ISLAND OF VICTORIA FALLS FROM DANGER POINT

The entire Zambezi River seems to drop into a great chasm at Victoria Falls. David Livingstone discovered the falls, naming them in honor of Queen Victoria. Natives call the cataract Mosi-oa-Tunga, "Sounding Smoke."

THE BOILING POT BELOW VICTORIA FALLS

Like Niagara, Victoria Falls have cut a long, deep, sinuous gorge in the black basalt below the cataract. The sides and ridges of this gorge, bathed perpetually in spray, are clothed with dense vegetation, the Rain Forest.

THE FIFE AND DRUM CORPS OF A UGANDA CHIEF

Photograph by Vittorio Sella

This orchestra is somewhat heavy in wood winds. Musicians of Central Africa press a good many things into service for flutes—sorghum, sugar cane, a certain kind of reed, and bamboo. Besides drums and [illegible] trumpets made from [illegible] horns, gourd horns, a kind of mandolin, and lyres. The Uganda harp is identical in form with harps in ancient Egyptian art and affords a hint concerning the history of the natives of this region.

Photograph by Vittorio Sella

A UGANDA ROAD THROUGH A PAPYRUS SWAMP

The familiar crest of papyrus seems again and again as a decorative motif in ancient Egyptian architecture; much as the top of the Nile lotus bud appears as a capital for the mighty columns. While Greece and Rome were still struggling along with the stylus and perishable wax tablets, the Egyptians were making stalks of their swamp reed into thin sheets on which to preserve written records. Our modern word "paper" is derived from papyrus.

ROCKY CANYON IN OUDTSHOORN, EAST OF CAPE TOWN

The largest ostrich farms in South Africa, where ostrich farming is a specialty, are found in Oudtshoorn. Dutch place names in the Cape of Good Hope Province are a reminder of the settlement of the Boers before their trek north into the unknown Transvaal, early in the nineteenth century.

Photograph by the Rev. Arthur J. Orner

AN OASIS OF FOREST IN THE SOUTH AFRICAN VELDT

Large timber is scarce in South Africa. Therefore the Silinda forest, covering two and one-half square miles, in the Melsetter district of Southern Rhodesia, is highly prized. The parklike Knysna forest, near the Cape, is probably the principal stand of timber in the south, while a struggling growth extends up the east coast to the Zambezi River.

A WITCH DOCTOR OF THE SHANGANI TRIBE IN SOUTHERN RHODESIA

Among the superstitious African natives a witch doctor is a person of great influence. During the tramp from Mwanza to Tabora (see map, page 128) the author, by entertaining his safari with tricks of magic, acquired a wide reputation as a witch doctor and whole villages flocked to see him at each halting place.

Immediately the black lady cried "Yip! Yip! Yip" in a shrill falsetto. It startled us. The Sudanese explained, "They *yip* like that when they are well pleased with themselves."

Just then the doctor came around to tell us the black buck chorus was singing "The White Lady is pleased with the Black Lady's dancing. (E-Yah! Boola-Boola! Wiggle-Wiggle! Walk.") Most of their songs are improvised from such extraneous, inspirational material.

'Twas a grand and glorious evening!

The party did not break up until the Count so forgot the tenets of European royalty that he commenced to dance with the natives.

While we were at breakfast in the open next morning a black girl came by with a wonderfully cicatrized body. We wanted a closer look at it, so Porter offered her some lump sugar. She had never seen lump sugar before; we had to suggest to her how to eat it. She found the result entirely satisfactory. Actually, we wished her on to ourselves for the rest of the stay there. Each hour of each day she came and begged a lump or two of sugar.

This peculiar form of decorating the body is done by slitting the skin and injecting some foreign material, which raises welts, according to a pattern, often in an elaborate raised floral design.

The Italian engineer invited us to go with him to shoot over a herd of wild elephants which made its headquarters near by, but because we did not dare miss the boat, we were obliged to remain close to the resthouse. There was no telling when the boat would arrive, nor when it would depart.

MISERABLE HOURS ON AN UPPER-NILE BOAT

The third night, at 10 o'clock, while at dinner in the engineer's shack, a whistle blew. The boat had arrived. A not-too-courteous white man who was in charge, and who was running two days late for reasons not explained, gave us just 10 minutes to pack our duffel in the dark.

Inasmuch as that particular white man was the only one of his kind we met in Africa, perhaps it is well not to discuss him. Let it suffice to say, he had stayed too long in the Tropics.

We were on board approximately within the limit.

We shoved off into the Nile in the Stygian darkness.

On board this miserable bumboat were swarms of Negroes, with this worse-for-wear white man in command. There were only two berths in the inadequate cabin. The gentlemanly captain had one and Porter got the other. The Count and I slept on deck on steamer rugs.

We tried to erect a mosquito net, as there were myriads of these winged pests, but the kindly captain refused to let us do so, as (he said) it blocked the view of the steersman. There was nowhere else to sleep. So for three nights of torture we sprawled on that hard deck and were bitten interminably by the poisonous insects.

There I contracted tropical fever, which stayed with me straight through to Cape Town and which at times made me suffer indescribably.

We were two days and three nights on this filthy, impossible boat. Meals were served by a Negro boy in scrofulous rags. Other Negroes, unspeakably dirty, crowded around the cookstove while the food was being prepared. The captain was past caring.

The rank vegetation of the upper Nile broke away from the banks in masses, dotting the stream with floating islands. Some of these islands were so solid one might camp upon them. We seemed to be sailing on a sea of lilypads.

The river itself appeared verdant, marshy, and malarial. The natives of the region exist in a pitiably primitive state.

There were thousands of crocodiles and hippopotami.

At one place where we stopped to load wood, there were 300 natives waiting for the boat to take them up the river. They stood in long queues, partly garbed in skins, with baggage consisting of food, pipes, weapons, and gourds.

The gourds have round, flat bodies like a small pumpkin, and long, slender necks. The natives polish them with the flat of their hands until they take color like a fine old meerschaum pipe.

The captain of our boat left the blacks where they were. He refused to take

THE FAVORITE AMUSEMENT OF THE GANG TRIBE IS DANCING

Much care is taken by the young men in bedecking themselves for the event, in which both sexes take part. In the foreground are two spearmen advancing, as if to make an attack. In the center are drums hung on a post, which are beaten to accompany the dance.

Photographs by A. L. Kitching

A GROUP OF GANG GIRLS OF NORTHERN UGANDA

Some of these women wear in the lower lip a glass spike made out of an old bottle, which has been split in a fire and a suitable piece ground to a smooth pencil on a flat stone (see text, page 160). The crates hanging above are used in carrying fowls.

Photograph by A. L. Kitching

THREE DRUMMERS OF WESTERN UGANDA

The short drums are covered with cowhide, but the head of the long, narrow one is made of the skin of the big water lizard, or monitor. These men belong to the native kingdom of Toro, in which are the famous "Mountains of the Moon" (the Ruwenzori Range) (pp. 164-165).

any of them for passengers. When they tried to come on board, he pursued them with a heavy stick and beat them unmercifully on the shoulders. It was rather absurd to see this madman chasing 300 savages back into the jungle.

A HIPPO HUNT ON LAKE ALBERT

When we reached Lake Albert the captain assumed a more conciliatory attitude toward his three white passengers. He invited us to go hunting hippos. By that time I had persuaded myself that the man was full of "climate," so we went for the adventure of it; but the Count refused to go. He advised the captain pointedly that hippo hunt or no hippo hunt, he would report him promptly to his superior the minute we reached port.

In a long boat propelled by twelve blacks we pursued hippos up and down Lake Albert. The skipper's nerves were shaky. He missed his targets at all yards, from 10 to 100. That added to the sport.

Across Lake Albert, on the western shore, is Mahagi, the proposed terminus of the Congo-Nile Railroad. Some day it will be a reality. Now it is a dream on paper.

The third night we were obliged to anchor for safety's sake. Lake Albert is a very large sheet of water and often is extremely rough. The captain dared not attempt to navigate the unseaworthy craft in the dark through such troubled waters.

At daybreak we started for Butiaba. I have never known rougher going. We

Photograph by A. L. Kitching

STARTLING COIFFURES ARE THE FASHION AMONG THE TESO PEOPLE OF SOUTHEAST UGANDA

The chignon is composed of hair, collected from the heads of deceased ancestors or off the head of the wearer, glued together with cow dung or blood and decorated with feathers.

sat like introspective statues on the cramped deck. To look full at one another presented fatal possibilities.

Presently the Count succumbed; he was seasick. He moaned and insisted that he was dying, thus enabling Porter and me to smile and so save the situation for us.

We arrived at Butiaba about 8 o'clock on a Sunday morning.

FIVE DAYS OF TENNIS AND SOCIABILITY IN UGANDA

By dirt road it is some 35 miles from Butiaba to Masindi, where we hoped to catch the boat bound across Lake Kioga, at 5:30 that same day; but, because of the laziness and blundering of the unsupervised blacks, we were delayed four hours in starting.

The old, worn-out motor truck that carried the three whites and a number of Negroes averaged but seven miles an hour.

We reached Masindi just in time for early dinner. Inasmuch as we had missed breakfast through choice and lunch without choice, we were deeply appreciative of that dinner.

This country between Lake Albert and Lake Kioga is of red soil, gorgeously beautiful to the eye. Occasionally we passed coffee *shambas*, where white men were attempting to carve a living out of the jungle. Throughout the World War, when prices were high, they made some progress, but now it seems a hopeless task.

There were elephant tracks all along the road.

Due to the shiftlessness of the blacks at Butiaba and the indifference of their white superiors, we missed the evening boat at Masindi Port, with the result that we were held up here for five days.

Actually, this delay was a disguised blessing, for in Masindi we found a very comfortable little hotel, with four bedrooms, living room, and dining room. This establishment was owned and operated by a famous major, who was not only a big-game hunter of renown, but a

Photograph by A. L. Kitching

NATIVE HUTS BUILT ON FLOATING ISLANDS IN LAKE KIOGA (SEE TEXT, PAGE 186)

Between the larger huts are seen tiny shrines, in which may be placed offerings to the spirits of the lake.

lover of flowers, which grew round his place in profusion.

We were welcomed by the English colony here, some eight or ten men and three or four ladies. We introduced a new equation into their perpetual tennis games. They had played together so much they knew the possibilities of one another's games thoroughly. To introduce the unknown quantity was to create a multitude of new combinations. Much good fun resulted.

They were very kind to us at Masindi.

FATHERS TAKE REVENGE ON ELEPHANT THAT DRANK BABIES' MILK

The natives of this post were a dressed-up crowd. Some say that many of these Uganda blacks are Nubians who retreated from the Sudan with Emin Pasha at the time that the Mad Mahdi broke loose. At any rate, these Masindi blacks are a generation or two ahead of the best blacks we met between there and Khartum.

Here we saw several large shipments of ivory on the way to the coast, bound for Europe (see illustration, page 158).

One night at Masindi I talked to a white man with a grievance. It seemed that a short time before a titled young Englishman had visited the post on an elephant hunt. He shot a cow elephant and captured its young one alive. The hunter fed the little one on tinned milk. It consumed a gross of these small tins a day. Before long most of the tinned milk in Masindi, originally intended for the human babies, had disappeared. To save the remaining supply, a party of fathers of infants organized a vigilance committee. Soon the baby elephant died from unknown causes.

We heard these selfsame white babies of all ages burbling to their native black boy "nurses" in the native language.

One day at Masindi one of the Englishmen and I found amusement in throwing my Australian boomerangs. The eccentric characteristic of the weapon made the natives think it was bewitched, and they scattered in wild disorder. For generations these blacks had been victimized by witch doctors, and as a consequence anything that is unusual is an object of terror to them (see page 178).

Photograph by A. L. Kitching

A VILLAGE OF THE GANG TRIBE, IN NORTHERN UGANDA

The smaller huts are granaries, for in the wet season, when there is no hunting, the Gang spend much time in their fields cultivating millet and sweet potatoes. The long lines hung from hut to hut are grass ropes, which are supposed to ward off lightning.

Photograph by A. L. Kitching

AMONG THE GURUGURU HILLS OF NORTHERN UGANDA

The caves in these hills were for years the resort of criminals and fugitives from justice, and a considerable force of military had to be sent by the British to "smoke" them out.

Photograph by A. L. Kitching

THE TOMB OF KING MUTESA, WHOM THE EXPLORER STANLEY FOUND ON THE THRONE OF BUGANDA (UGANDA) IN 1875

Mutesa, who welcomed Speke and Grant (see page 170) in a friendly manner, was succeeded by his son, Mwanga, who was deported by the British Government and died in the Seychelles Islands. His body was brought over and buried beside that of his father.

The boat on Lake Kioga was a clean, comfortable little craft, in charge of a jolly, efficient Scotch captain. We sailed all around the lake and stopped at many small ports to pick up cotton, in the cultivation of which the white men were trying to interest the natives. Apparently something is going to come of this campaign, because the natives are learning that the white man will pay money for cotton, and that money buys things.

There were four British traders and officials on board who had come up from Lake Victoria. Of course, they all carried guns, so we had some good sport sniping crocodiles (see page 214).

WHERE THE NILE BEGINS

Lake Kioga is a part of the Nile system.

When the river leaves the green hills of Lake Victoria, it hurries tempestuously toward the sea. Soon the land becomes marshy, and the stream must fight its way through papyrus swamps. It becomes discouraged, repents, and tries to turn back. That is Lake Kioga.

After the struggle at Lake Kioga, the Nile again finds green hills and pleasant surroundings. There it stops to rest and meditate. That is Lake Albert.

Both these lakes are really wide places in the mighty stream.

Lake Kioga was to me extremely uninteresting. The little ports were merely small wharves and cotton sheds. I developed a slight case of "sun," and that, complicated with Lake Albert fever, made me indifferent.

Here we experienced several furious tropical storms under particularly favorable conditions. We saw them coming a long way off. Then they struck us, deluged us, engulfed us. For perhaps 10 minutes we were drowned out.

When the storm passed, the air was cool.

On deck, we all admired the beautiful multicolored, iridescent African skies. There seemed to be no "roof" to them.

Photograph by A. L. Kitching

INTERIOR OF THE TOMB OF KING MUTESA (SEE ALSO PAGE 186)

The body is interred behind the line of spears and other weapons. In the aisles to either side of the lines of posts formerly sat old women, widows of the deceased monarch, who took turns in guarding the tomb.

Lazily we sailed through channels of water lilies, down the silent avenues of papyrus swamps (see page 175).

Finally we reached Namasagali and boarded the little train for Jinja, five hours away, on the shore of Lake Victoria.

The route we followed down through Africa zigzags a little, but it was always south.

After we left Namasagali we passed through a high, fertile country, dotted with banana and pineapple plantations. The banana is one of the staple foods of this region. We bought luscious pineapples from the natives for five cents each, which flagrantly overpaid them.

All the natives within walking distance of the railroad were present and accounted for when the train came in. Their impressions of civilization come to them in trainloads. The twentieth century A. D. rolled in on them unannounced and found them in the twentieth century B. C. They have not yet recovered from the wonder of it.

Ant hills the size and dimensions of native huts, high country of transcendent fertility, a multitude of trees, tall grass, groups of raw natives lost in wonder, and clean little railroad stations—these were the oft-repeated impressions on the road to Jinja.

The hotel at Jinja was a group of temporary structures, which is the technical name for a series of native straw-and-mud huts. Even so, the management was courteous and obliging, the food well served, the beds clean. We were made very comfortable.

ON THE SHORES OF THE SECOND LARGEST FRESH-WATER LAKE IN THE WORLD

Jinja rests on the hills over Lake Victoria. This lake is quite a stretch of water, some 250 miles long, second only to Lake Superior in size, and the source of the River Nile. While we dined we could hear the roar of the river as it broke away for its journey down into Egypt (see illustration, page 170).

Ripon Falls were something less than

Photograph by H. T. Cowling

A TOPÉE IMPALED UPON AFRICAN "BARBED-WIRE" ENTANGLEMENTS

Mimosa thorn shrubs, which grow abundantly in central East Africa, are used by natives to protect their homes against wild animals. Mimosa, in the form of a palisade around a village, is called a *boma*. In killing lions a boma, or thorn barricade for a combination blind and fort, is built near the bait (see text, page 205).

a mile away. A tablet at the falls commemorates Captain J. H. Speke, the Englishman who discovered them for the European world on July 28, 1862. The falls were small and insignificant, we thought, for the source of such a river as the Nile.

Unless one wished to go shooting hippos, or buffaloes in the hills beyond the lake, there was very little to do in Jinja.

These African buffaloes are extraordinary creatures. They are not at all like the American bison. Some of them have huge pairs of horns, which grow solidly across their foreheads. They are cow-like animals in appearance, but not cow-like in disposition, for most white hunters in Africa agree they are among the most dangerous of wild beasts. Once a buffalo is wounded, he seems to run away from the hunter, but that is only a ruse. Actually, he circles round, quietly and stealthily approaching the hunter from the rear. Then, in a last furious rush, he attempts to kill his quarry. Very often he succeeds in doing so.

We found all African prices for imported goods exorbitant, and all usable goods were imported. When we reached a settlement we had to replenish our stock. For American-made goods the prices averaged three times the standard prices in America.

Wherever we went we found friendly men of our own race, who gave us information concerning the next lap of the journey. We developed a high regard for the white man who is marooned in Africa.

We waited at Jinja for the boat to take us across Lake Victoria to Kisumu, the lake port of Kenya Colony.

WORK WITHOUT NOISE IS IMPOSSIBLE IN AFRICA

In Jinja we saw a degrading sight. A number of black prisoners were chained together with steel dog collars around their necks. These men had committed only petty crimes, but unless they are chained together, they run off into the jungle whenever the opportunity offers.

These convict gangs cut most of the soft dirt roads through the jungle, and so open up the country to civilization.

African natives find it impossible to do any kind of work except with an accompaniment of noise. When our boat, the *Clement Hill,* arrived we were greatly amused at a sight on the docks. While we were waiting for the gangplank to be let down, a group of blacks began beating improvised drums, shouting and leaping to the music.

"Who are these natives and what are they doing?" I asked a white man.

"These are the ship's stevedores. They always dance to get themselves excited, so they can work."

Here we said goodbye to the Count.

We crossed direct to Kisumu in something less than 24 hours. All the available cabins were filled with British officials and their wives, who were going home on leave, bound for the seaport of Mombasa; so I was obliged to sleep on a bench in the saloon. That did not bother me very much, because I burned up with fever all the way. In comparison, the inconvenience seemed slight.

Photograph by Vittorio Sella

A DRUMMER BOY OF UGANDA

In some African villages there are three big drums. The largest is called "Bugendanwe." Next to it is placed a smaller one, called its wife. The third, still smaller, is its prime minister. Most Uganda drums are hollowed pieces of wood with oxhide heads.

Kisumu, on the shore of Victoria, is some 3,700 feet above sea level; Nairobi is nearly 5,500 feet. Therefore when we left Kisumu we began to climb. The train mounted the Kikuyu escarpment, with an elevation of 8,000 feet, and we began to experience arctic cold, although this railroad is almost on the Equator. Steamer rugs were a necessity; I mixed chills with fever the night through.

IN NAIROBI, LARGEST TOWN OF CENTRAL AFRICA

Nairobi is the largest town in Central Africa, is a seat of the British Government, very desirably situated, and rather pretends to be a city after the tropical design, though there is nothing tropical about Kenya Colony thereabouts.

The adjacent country is mountainous. The naked native blacks seemed out of place. The English have very strenuously attempted to make the region civi-

Photograph by P. De Lord from O. W. Barrett

A GROUP OF WARRIORS IN KENYA COLONY WEARING HATS THAT WOULD ASTONISH PARIS

The Kavirondo tribes east of Lake Victoria go in for elaborate millinery. They cover crowns of basketwork with white kaolin striped with black mud. The crowns are then trimmed with ostrich feathers and plumes of other birds. The models are exclusive—no two alike. Some are more than three feet high. A witch doctor crouches in the center of the assembly. The Kavirondo have been decimated by sleeping sickness.

lized and productive, with the result that it is the best of the so-called White Man's Country in Central Africa.

Though Kenya Colony is located on the Equator, such is the altitude that the European residents have winter sports—skating, tobogganing, and skiing.

There is a distinctive kind of native in Kenya Colony.

In and around Nairobi the women shave their heads and pierce and distend their ear lobes to outlandish limits. When the ears are free of decorations, these mutilated lobes hang in loops, but usually pieces of wood or metal jewelry fill the spaces. These decorations assume the proportions of saucers. Under the ear chrysanthemums of copper wire, wrapped in bright-colored silk, give a color contrast to the dusky complexion. Arms and legs are decorated with bracelets and anklets of copper wire. Over parts of their bodies, draped like a Roman toga, they wear a single garment of tanned skin of a soft brown color.

Most of the women carry burdens slung on their backs, steadied by a strap across the forehead. They stoop as they walk. One sees thousands of these bent-over, shuffling, barbaric figures (see page 205).

IN THE SHADOW OF THE ROOSEVELT TREE

In Nairobi we stayed at the Norfolk Hotel, outside which there is a tree bearing this legend: "This tree was planted by the Honorable Colonel Theodore Roosevelt." Unfortunately, it is being crowded out by another tree and is dying.

We decided, by the map, to push down through the Masai

Photograph by H. T. Cowling

THE ASSEMBLED ORCHESTRA FOR A WAKAMBA DANCE: KENYA COLONY

Drums are the only instruments necessary for a native dance, although varieties of flutes and xylophones are used. The numerous Wakamba, living in Kenya Colony, speak the purest Bantu to be found in East Africa. While there are more than 500 languages in Africa, the problem of understanding them is not so hard as their number would suggest, for many of them are dialects of Bantu, so that a native from the Cameroons usually can make himself understood by natives in the Congo, Rhodesia, or Zanzibar.

Photograph by Capt. W. Madgin

A PINNACLE RAISED BY ANTS IN KENYA COLONY

This spire was 35 feet high when this picture was taken, two years ago, and it was still going up. Towers and humps built by big colonies of white ants are familiar features of Kenya and Uganda landscapes. Some tribes relish these ants as a delicacy.

country, to the east of Lake Victoria. Whether such a route existed we did not know. We only knew that the Masai, the most turbulent tribe in Central Africa, were again on the warpath. They had killed some Hindu traders a short time before. That promised excitement.

Those whom we consulted in Nairobi said the Masai country was not safe. That made us want to go all the more. But we could not persuade a guide in Nairobi to accompany us to Mwanza, on the southern shore of Lake Victoria, as all claimed there were no paths and no water, and that the Masai were in a hostile mood.

After three days of sustained effort we became rather pessimistic. We had accomplished nothing.

Eventually we induced an English planter, who was looking for an engagement, to accompany us to the edge of the Masai country for a hunt. There we expected to discover whether it would be possible to get through.

A LION HUNT IS DECIDED UPON

When first we talked with the White Hunter, he asked us what we wished to shoot.

"Oh, we wish to shoot lions."

Up until that minute I had not thought of what I wanted to shoot. Never in my life had I gone hunting.

"Righto! I think we can find lions," he replied.

Thus, casually and irresponsibly, were we committed to a lion hunt.

We left Nairobi at 7 a. m., in a little American-made car, to cover some 75 miles, to where the lion has his haunts.

One mile outside Nairobi the road degenerated into a wagon track across low lush meadows, simply soft mud. We had chains on the wheels all day. We got stuck innumerable times. We had to get out and push. We skidded at every turn. We had three punctures.

This is the principal road in Kenya Colony.

The Masai are still the most warlike and most feared of all the African tribes. They are a cattle-owning people. They live on cows' milk and cows' blood. They consider agricultural work disgraceful. The little flour and such which they require they get by trade.

Incidentally, they have cattle tick and cattle fever rampant among their vast herds; so there is a quarantine station on the edge of the Masai country to keep their cattle and the consequent contamination out of Kenya.

This quarantine station, a one-room shed on stilts, was to be our headquarters

while we hunted lions. This saved buying and carrying a tent.

A GIGANTIC ZOO IN THE OPEN

More or less, I have seen the sights of the world, but I shall never forget the thrill as we came into the Kedong Valley, five miles from this quarantine station. I expected to see big game in Africa; I had seen some. But my idea of hunting (purely academic) was to go out and search around till an animal appeared on the horizon; then take a quick shot at it and trust to luck. Imagine, then, the spectacle of *thousands* of animals within the radius of a few hundred yards of our car, grazing peacefully, such animals as one usually sees in the zoo.

We were amazed and delighted.

We stopped the car for a better view and to hold conversation with two naked braves, who, all dressed up, were journeying toward some trysting place. Their hair, raised in pompom fashion, was matted with an oily red mud and braided into little ropes. Their bodies were painted with eccentric spirals in white. They wore rings in their noses and ears. They were very grand and very polite and very curious, especially about Porter.

The Kedong Valley consists of a series of gently undulating plains with pocketlike grazing grounds intruding into the foothills. Occasional shaggy outcroppings of rocks, hummocks and ledges provide shelter for the game and points of vantage for the hunter.

Photograph by H. T. Cowling

A MASAI LION KILLER

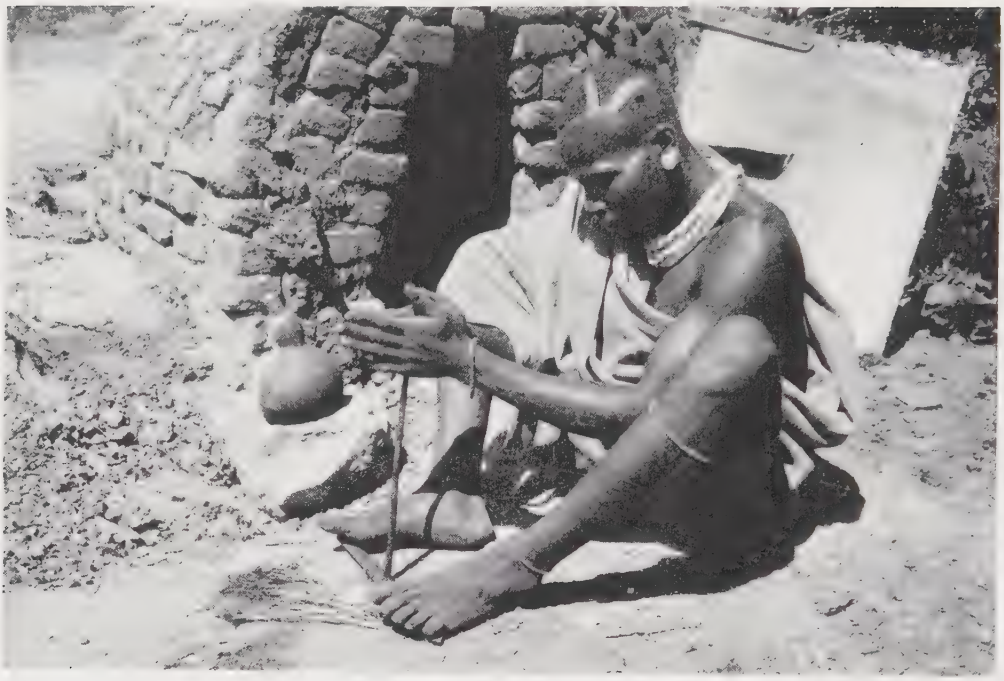
The headdress, made from the mane of a lion, shows this warrior has killed a lion with his own spear. The Masai prefer buffalo hide for the big oval shields, but will use oxhide. The leather is sewed on a hoop, and down the center, on the inside, is a broad lath. Usually designs on the shield show the hunter's clan. The Masai of the Tanganyika and Kenya uplands are one of the fiercest tribes in Africa (see text, page 192).

A ZEBRA SAVES AN AMATEUR'S REPUTATION

Next morning we turned out at daybreak.

The grass, four feet high, was wet. Before we walked 100 yards we were soaked to the waist. No one cared for that, because the most interesting sport in all the world was before us. The golf mania is as nothing compared to the big-game mania.

That first morning the rising sun found the plains full of elands, kongoni, antelopes, Grant's gazelle, Thomson's gazelle, zebras, ostriches, giraffes, hyenas, foxes, wild dogs, jackals—literally, thousands of animals. We forgot that we were there to shoot and stopped in wonder to admire.



A WAKAMBA NATIVE MAKING FIRE WITH TWO STICKS: KENYA COLONY

Photographs by H. T. Cowling

ARBITERS OF FEMININE FASHIONS AMONG THE MASAI WOMEN

In some regions of Africa it is almost impossible to maintain telegraph service. The beaux and belles of native tribes are so anxious for copper wire to make into ornaments that they will raid a telegraph line if the occasion offers. Some of the most fashionably wired native women wear as much as 12 or 15 pounds of metal on each leg (see text, page 217).

Photograph by Felix Shay

MRS. SHAY'S METHOD OF FORDING A CROCODILE-INFESTED STREAM

A mile or more from the camp we came on a herd of zebras, say 70 yards away, that stood stock-still and stared.

The White Hunter suggested, "Go ahead, take a shot."

I dropped to one knee and let go.

The zebra at which I aimed kicked his heels into the air and fled to parts unknown.

One is neither discouraged nor disconcerted when one expects to miss—aye, prefers to miss—for I have not the stomach of a hunter. I hate to kill things.

On we went again, and the "honor" was now Porter's.

We turned the corner of a rocky abutment. Down below us, on the plain, 200 yards away, was a herd of kongoni, a variety of horned beast which weighs at maturity about 300 pounds. Porter sat down like a professional, leveled her gun on her knee, and promptly knocked over a large male.

First blood to Porter. We arranged the beast and photographed her and it, she trying vainly to conceal her elation. She is a Canadian and something of a big-game hunter; she gets a thrill out of it.

"Well," suggested our mentor and

Photograph by H. T. Cowling

ON A KENYA COLONY COFFEE PLANTATION

Coffee is a coming crop in Africa, the continent of its origin. Arabs are supposed to have found the variety now in principal use in the Kaffa district of Abyssinia. Other species of wild coffee trees are found in many places in Africa, and beans from some trees have remarkable aroma and flavor. Cultivation of coffee trees is now being promoted in the uplands of Kenya Colony, Uganda, Congo, and in various other places throughout Africa.

guide, "shall we have some breakfast?" We were all agreeable.

Across the plains Porter explained to me the defect in my stance, and how my gun should not have wiggle-waggled. She insinuated that I lacked poise.

Of necessity I was meek enough. One must face the facts.

Then the hunter questioned, "What is that over under that tree?" He put his field glasses on it. It was a dead zebra!

I never looked at Porter while we walked over. I was hoping against hope. Sure enough, there, dead under the tree, shot five inches behind the shoulder, was *my* zebra! Right on the center of the target!

Did I gloat? No! I said only one sentence to Porter. Quietly, when the White Hunter was not listening, I mentioned that pertinent phrase, "Woman's place is in the home."

Two Kuku natives turned up at the shack. We engaged them as gun-bearers, skinners, and general all-round helpers, at a shilling a day each. This business of hunting was becoming complicated.

A SHORT HUNT MAY COST $25,000

To understand a "hunt" in Central Africa, one must understand the condition of a man's pocketbook. There are hunts and hunts!

Many rich men come out here with guns enough to start a Central American revolution. They engage a safari of 100 or more natives. They take out a dozen or more cooks, camp boys, and personal boys. They bring luxurious tents. They pack a wine cellar and multitudinous cases of food. They engage two, three, or more professional hunters—crack shots. They take along a score of beaters to find the game and drive it in. They live with as much convenience and comfort in the field as they live at home. A short hunt of this character may cost from $5,000 to $25,000.

Photograph by H. T. Cowling

DRYING SISAL IN KENYA COLONY

Sisal is a native of Yucatan, Mexico, but East Africa now exports great quantities of it to the world's markets. Africa's capture of sisal, a New World plant, affords commercial revenge for Brazil's control of coffee, a native of Africa. A native will cut 1,000 sisal leaves a day for 16 cents. The fiber is used for twine, mats, and bags.

Before I left Nairobi I told our White Hunter that we sought neither self-deception nor trophies; that we wanted sport. I told him we wanted the privilege of shooting and missing or shooting and hitting.

He was not to shoot until we had missed fair. If the animal fell, it belonged to him. We wanted none of it.

Nor were we keen on a general butchery; one or two souvenirs of the hunt would be quite enough for us.

He was glad to agree.

I find that few of these professional hunters have sympathy for wanton killing. Here, as elsewhere, the "game hog" is unpopular.

After lunch we went out to prepare the dead zebra for lion bait. To keep off the hyenas, the jackals, and the ever-present myriads of vultures, the carcass had to be covered with thorn bushes throughout the day, which were removed at dusk.

Remember, this was a lion hunt! Lions must be baited.

When the dead zebra was fixed just so, we made a 10-mile circle around the plain and saw hundreds of animals within easy shooting range, but we desisted. The spectacle of these beautiful strange animals, in their native habitat, grazing peacefully and unafraid, was rather a satisfactory adventure in itself.

Late that afternoon, at a distance of less than 50 yards, which was nothing on these broad plains, we saw five giant ostriches in single-file parade. There were three black cocks, each with a gorgeous plume of white tail feathers, and two dun-colored females. Off they stalked majestically, not at all in haste, while we sat and watched them.

AMONG THE "MAN-EATERS OF TSAVO"

That night the lions roared all around us.

One who has not heard a lion roar on the plains of Africa has not heard the most awe-inspiring sound in all the world!

Both of us had just finished reading

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A LAKE OF CRYSTALLIZED SODA 16 MILES LONG AND 4 MILES WIDE: KENYA COLONY

A huge block of the substance has just been pried from the lake bottom. Waters flowing into the lake have brought soda in solution, and the glare of the tropical sun has evaporated the water, leaving the alkaline compound in crystal form.

© Publishers' Photo Service

A NARROW-GAUGE TRACK ACROSS THE SODA LAKE, IN KENYA COLONY (SEE ALSO OPPOSITE PAGE)

This depression, 250 miles west of Mombasa, has enough soda to satisfy the world's needs for some time. The narrow-gauge track on the soda "ice" belongs to a British company, which is digging and marketing the chemical. The deposit is estimated at 200,000,000 tons.

Photograph by H. T. Cowling

N'GOMA, OR DANCE BY WAKAMBAS OF KENYA COLONY

Only young men and unmarried women take part in this dance. The "puttees" on the young braves are clay whitewash. When a young man manifests interest in a certain young woman, his father and her's arrange the marriage bargain. The cost of a wife depends on the bridegroom's ability to pay. A chief might have to pay 100 goats for a wife, while a poor man could get the same girl for 40 goats. The marriage price is usually paid in installments.

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DANDIES OF THE KIKUYU TRIBE, KENYA COLONY

Gourds such as these four braves carry are common receptacles. Little pottery is made by African natives. Ear ornaments find great favor among tribes in this region. The man on the left wears two cylinders of wood in the lobes of his ears, which have been pierced and stretched. Women of an adjacent tribe pierce the lower lip, stretching it until it will receive a large block of wood. (See also "Curious and Characteristic Customs of Central African Tribes," by E. Torday, in THE GEOGRAPHIC for October, 1919.)

Photograph by Capt. W. Madgin

A HOME IN A TREE: KENYA COLONY

Outcasts of the Turkana tribe have taken to the trees in building houses to store away proceeds of raids. The Turkana call these outcasts People of the Trees. In southern Kenya Colony a Wakamba tribe builds shelters in trees, so that their nightly slumbers will not be disturbed by rhinoceroses or buffaloes.

Colonel J. H. Patterson's "The Man-Eaters of Tsavo." In this book the engineer who constructed the railroad from Mombasa to Nairobi relates his actual experiences with the lions that killed several white men, 28 Indian coolies, and scores of natives.

These Tsavo lions actually delayed the construction of this railroad for months, because of the panic they created among the railroad workers. This subject was eventually brought up for discussion in the British Parliament in London.

Of all the books to give one creeps, this best achieves its purpose. I fear we doughty lion hunters rather quaked between our blankets that night, when we remembered that those roars so close outside emanated from beasts whom we were to engage in the morning.

We turned out at 3:30 a. m. to catch the lion on the bait with the first flush of daylight. This meant that we would kill or be killed before sunrise—an inspiring hour!

I carried the gun that delivered the heaviest blow, a .375 express rifle of English make. Therefore I was to have first shot.

Once in for it, I resolved that my first shot must do the work. It is a notorious fact that a lion charges when wounded, and he moves with startling speed. His ability to cover the first 80 yards in no time defies the imagination. One must see him do it.

All hunters agree the lion can overtake any animal in a race of 80 yards or less. For that distance he is the swiftest animal alive. After that, he tires rapidly.

The unbroken trail led through the high, wet grass. It was still dark. A large black form loomed in front of us. "Sh! What is that?" Up went the rifles. By the slant of the back of the animal silhouetted against the sky, one could tell it was a giant hyena.

Other hyenas and jackals skulked by.

That they were off the bait told us convincingly that a lion must be on it.

By Jove, this *was* sport! This WAS a thrill!

THE LION PRESENTS A TARGET

The morning was cold, *cold*. The East African days are burning hot, and the nights are freezing cold. We wore "woolies" and heavy clothes, but we were cold. We blew on our hands to warm them, the better to grasp the rifles. Another five minutes and we would be there!

Photograph by H. T. Cowling

THINKING IS NOT THE ONLY FUNCTION OF A HEAD IN KENYA COLONY
(SEE ALSO PAGE 205)

Unexpectedly we took the last rise in the land and came in full view of the bait.

"There he is! *Shoot! Shoot!*"

There he was, and no doubt!

Resting flat on the zebra was a full-maned, full-sized male lion. The grass was too high to drop to one knee. I had to shoot from the shoulder. He glared at us, but did not move. I put my rifle to my shoulder, said a short prayer to the God - of - things-as-they-ought-to-be, and fired.

The big beast offered me a full side shot, a still target at 60 yards.

I aimed steadily, confidently, for the vital spot, just behind the shoulder. I fired and I missed!

I did not know I had missed. Naturally, I thought I hit him. I was concentrating on another problem. With the first bullet fired, I pumped the magazine to throw out the old cartridge. Out went the old, but the magazine of the gun, which the dealer in Nairobi assured me was in "perfect condition," refused to function.

The cartridge did not jam; the weak spring of the magazine simply refused to throw the next cartridge into the barrel.

I could not look up; the task was under my hand!

I plunged my thumb into the magazine to stimulate the spring, and took skin off the thumb without result. I swept my hand into my pocket, found a loose cartridge, snapped it into the barrel, and

Photograph by K. Kittenberger

FEEDING A MONTH-OLD RHINOCEROS BABY

The rhinoceros is widely distributed in Africa south of the Sahara Desert, except in the Congo Basin. Although they are divided roughly into the black rhinoceroses and the white rhinoceroses, the latter are less numerous. In color they are actually black and less black. Parties of lions will attack a calf rhinoceros, but an adult fears no animal.

looked up. I expected to find the lion in front of me, asking, "Am I too late for breakfast?"

While I was struggling with the gun I dimly heard a rattle of musketry. To me it seemed a long way off and far removed. I disassociated it with my dilemma. When I looked up, there was Mr. Lion scurrying over the far hill, with bullets to left of him, bullets to right of him, bullets in back of him. Both Porter and the White Hunter had emptied the magazines of their guns while Mr. Lion buck-jumped through the grass.

Then the two guilty ones turned on me and wrathfully accused *me* of missing the lion! Well, there are times when one can not condescend to argue.

WE BUILD A "BOMA"

That day we were in a furor of excitement.

To kill a lion became an obsession.

Lesser animals were suddenly unattractive.

Immediately after breakfast we went out to kill another zebra for bait, and, if possible, to effect the kill in a particular locality, so the bait would be located favorably.

This was no easy task. The zebras refused to come or to be driven where we wanted them. After two hours of stalking them ineffectually, we held a conference. We decided to kill one in the open and then engage native oxen to draw it a couple of miles across the plain, thus leaving a line of scent, and place it exactly where we wanted it. We scattered to get close to a zebra herd a mile away in the open.

Porter and the White Hunter shot simultaneously. The latter dropped his with a bullet through the heart, while Porter turned her zebra over twice with a bullet head-on through the chest.

Then we hailed a Kuku native in a red blanket, who lived in a near-by grass hut. He found the necessary oxen. These were attached to the two zebras and they

were dragged to high land, where there were some thorn bushes and small trees.

We planned to build a *boma*. To make the structure seem natural, the near-by landscape must be similar.

A boma is a small-sized fort made of thorn bushes, in the form of a complete circle. It is supposed to protect the hunter from the lion. The lion is supposed to fear it as a trap. We could only trust these suppositions were correct.

We planned to sit up all night in the boma, with the bait in front of us, and wait for the lion to come along and settle down to the banquet. Porter was to have first shot, and—well, I could only think thoughts of pity for that lion.

Mentally, I began to select places for the lion's skin on our living-room floor at home.

We wended our way back to the shack for lunch.

Photograph by H. T. Cowling

A KENYA WOMAN WITH A DOUBLE BURDEN

The strap support over the head is widely used in East Africa to supplement thongs over the shoulders. In consequence women, who do practically all the burden-bearing, are often permanently stooped (see text, page 190).

Along the trail we scared five little foxes out of the bush. They were no larger than house cats.

In the afternoon, we refrained from shooting, in order not to frighten off the prospective lion. We took a preparatory nap instead.

When the sun set we started for the boma, with a steamer rug each, as protection against the damp and cold.

Once in the boma, we must be as still as death itself. That's an easy task for an hour. But not to speak, not to stir for ten hours—! That night I kept the faith faithfully, but I am through with bomas forever and a day.

Even so, the long night out on the plains with thousands of animals prowling about, the strange and threatening noises, the queer sounds, the smells, the silence, the vastness, the eerie moon—these are to me an unforgettable memory.

THE AUTHOR SHOOTS HIS LAST GAZELLE

Once in the night a circle of little jackals came around and yipped at us. Once a hyena laughed near by. There was something suggestive in his laugh. The

Photograph by Vittorio Sella

A LATEEN SAIL ON LAKE VICTORIA

Among the world's fresh-water lakes, Victoria is exceeded in area by Lake Superior only. It is the chief reservoir of the Nile, and from Ripon Falls, the lake's outlet, to the mouth of Egypt's mighty river the water route is longer than the distance between New York and San Francisco.

lion never came. Porter never killed it! The rug in the living room will have to be an afghan from Peshawar.

Meanwhile, I resolved to get a pair of gazelle horns for the family carving knife and fork.

At 200 yards, I was offered a shot at a Thomson's gazelle, a male with very nice, long horns. These little creatures are about the size of a goat, with a black and white stripe down the dun-colored side. The Tommie would only give me his tail to shoot at. He looked back over his left shoulder with a critical eye. My companions waited fretfully while I took his measure.

Then I let him have it with the heavy gun. I hit him in the hind quarter. The bullet ricocheted and pierced the brain. He died instantly. My reputation as a hunter was restored and on this planet I have shot my last gazelle. Alive, they are beautiful, graceful little beings; dead, they are gory masses.

Each morning we hunted lions without success. Between times we shot several varieties of horned beasts, enough to supply us with fresh meat and a few trophies.

One day as we strolled about the plains we fell in with a monster mother giraffe and her young one. The mother moved off, but the silly youngster stopped to look us over. He halted within 30 yards of us. An hour later we encountered eight giraffes, six grown ones and two youngsters. What beautiful creatures they are!

The head of the family, a gigantic male, moved forward to inspect us. These animals are royal game in Africa; a hunter is required to have an extra-special license to kill them. Therefore, they have been shot over very little, and as a consequence are unafraid. The old male, a wonderful fellow with large, brown spots, and a white head, came as near as 40 yards, and gazed at us quizzically over a tree top.

Whenever we fired a shot on the plains the rumble of the animals' hoofs running

Photograph by Felix Shay

GERMANY'S HELGOLAND ON LAKE VICTORIA

"A short distance offshore is a sizable island, with picturesque boulders thrown about in confusion. There are hundreds of balancing stones, caves, and lookouts. During the World War the Germans scanned the lake from this vantage point until they were driven out" (see text, page 210).

for cover (or distance) sounded like thunder.

Africa is a marvelous country.

We were sorry to finish the hunt, but we had killed all we wished to kill *except* a lion.

We decided to move upcountry for a day to hunt around for baboons. We did not desire to kill them, but we did wish to get close and spend a day among them.

The most relentless hunter will not shoot a monkey or a baboon, if he can possibly avoid it. When hit they cry like babies and try to tear the bullet out of the wound with their hands—a very unpleasant experience for the hunter.

AN INVITATION TO ESCORT SLAYERS TO TRIAL IS DECLINED

While we were at the quarantine shack an American missionary, who had spent 10 years in the Masai country, arrived one evening in an oxcart. He had been "gee-hawing" for 12 hours. We invited him to dinner. He told us there was no road or path through the Masai country to Mwanza. And even if a path existed, there was no water!

So that was that—the final word!

We would have to sail down Lake Victoria to reach Mwanza, in what was once German East Africa.

While we were at the quarantine camp a British officer arrived with a company of native soldiers. He was trekking down into the Masai country to bring up in chains 175 of the warpath tribesmen. The trouble for the present was finished. One or more East Indians and several natives had been murdered. Five or six of the 175 Masai would pay with their lives. The tribe had been fined 10,000 cattle. The Britisher invited us to go along with him. The trip might take a couple of months.

Suppose at the last moment the warlike Masai decided they would not have the criminals taken out of the country? Then there *might* be a scrimmage.

AMONG THE BABOONS OF KENYA

We wished very much to go, but we remembered we were bound for Cape Town. Instead, we went after baboons.

These little "old men" of the forests live on rocky hillsides which are densely wooded. If there is a stream near by, so much the better.

© Famous Players-Lasky Corporation

LADIES OF LILLIPUT

Although they are often no larger than an eight-year-old American boy, Pygmies dare to hunt elephants. Stealing on a herd through the grass, they bring their quarry to earth, hamstringing it with a quick knife slash (see text, page 145). The Pygmies of the illustration belong to the Bambute tribe of northeast Belgian Congo.

We found them along a stream, under thick foliage.

We three went in at different places. I crept along the bank, and soon I saw a male and a female walking toward a tree. They were upright, but slightly bent over. They walked slowly, like centenarians. I shouted and struck a bush. Immediately the tired figures became chain lightning. They went up a tree and into another, and another, and were gone in a flash of a second.

Then the forest woke up and barked at us.

Baboons utter a single, sharp, harsh bark, oft repeated.

One old man came out on a tree near us and yelled a challenge at us. He barked and barked and lost his temper and acted disgracefully. We decided he was showing off before the monkey villagers, so we sent a shot far over his head to reduce his ego. He nearly died of nervous prostration and fell down half the tree getting away.

Months afterwards, in South African newspapers, we read of the trial of the warlike Masai. These natives hold that a man's not a man until he puts blood on his spear—human blood. Until he kills, a youth is not a brave. That custom still prevails. Usually, the girls taunt the young bucks who have *not* qualified. That starts the trouble. They go out then to show the stuff that's in them, and the first person they meet dies.

Some dozens of the Masai who were involved in the killing of the East Indians were deported; seven were condemned to death. Among the condemned men was Chief Medicine Man. So great was the fear of his "evil eye" that natives refused to testify against him in court until he was forced to turn his back to them.

Two dozen of these same Masai slept on the dirt under the raised quarantine shack every night we were there.

PREPARING FOR A 300-MILE TRAMP

One curious feature about Africa is that the Sudan, Uganda, Kenya, Tangan-

Photograph by Porter Shay

THEY COULDN'T RESIST A SWIMMING HOLE

"Up in the Sudan, and here in Tanganyika as well, whenever we reached water the boys took off their loin cloths and went in for a swim. Only one out of a dozen seemed able to swim. The rest simply paddled and bathed" (see text, page 221).

yika, Rhodesia, and South Africa, all under the British flag, are governed as separate countries. As we entered each we were obliged to pass through customs.

We crossed Lake Victoria from Kisumu to Mwanza, a journey of 48 hours, in the company of a Scotch captain, a Scotch engineer, and as pleasant a group of white men as one could hope to meet anywhere. The day we tied up at Mwanza a British officer, who had spent some years in the United States, came on board and insisted that he had the right to be our host; but before Captain Bruce would let us leave he called out his small boat and took us to some of the rocky islands near Mwanza, where we picnicked and hunted iguanas. Some of these giant lizards were five or six feet long and six or seven inches in diameter.

These islands were covered with wild orchids.

From Mwanza to Tabora, up south through Tanganyika, we were obliged to walk a distance supposed to be 300 miles. Apart from our camp beds, kettles and pans, and the ever-trusty revolver, we had no other camp equipment.

We were told on board the boat to "see Bolini." Bolini is an Italian, a trader, and the oldest white settler in Mwanza.

Our friend the British officer found Bolini for us.

Bolini kindly lent us a tent, which we were to send back to him by our black boys when they returned, after we had released them at Tabora.

Certain of the white men whom we had met in Kenya Colony advised that we take a *machila* (a hammock) on this long march; but Porter would have none of it. She insisted that she was going to walk, and that she did not want a machila with us, lest it raise the question as to whether

Photograph by Porter Shay

A TANGANYIKA TERRITORY FISH STORY WITH EVIDENCE

"When we came to a certain stream of flowing water, some of our boys waded in to their knees and with their bare hands proceeded to catch about 25 fish each" (see text, page 221).

or not she did walk. So, though Bolini offered us one, we declined it with thanks.

Mwanza, in Tanganyika, is the principal port for this territory on the south end of Lake Victoria. Viewed from the lake, it is a pile of massive granite rocks, on top of which is a kind of fort. This was formerly a German stronghold.

A short distance offshore is a sizable island, with picturesque boulders thrown about in confusion. There are hundreds of balancing stones, caves, and lookouts. During the World War the Germans scanned the lake from this vantage point until they were driven out* (see illustration, page 207).

There was a statue of Bismarck in the dusty public square, but recently, on the British sovereign's birthday, the marooned Englishmen, in a spirit of levity, took down the statue and put it in the compound of the public jail.

HOSPITALITY IN THE HEART OF AFRICA

We stayed in Mwanza four days.

The night of the first day Bolini, aided and abetted by the other white men of the station and the ship's officers, gave a little dinner in our honor. Bolini served roast suckling pig and Italian wine. I am afraid we did not turn in until late.

The Englishman who had spent eight years in the United States, largely in California, insisted on talking American slang, strictly of the pre-war period. Much of it was so obsolete it was doubly funny.

This same Englishman turned over the living room of his house to us for a camp. In these far-off places it is common practice for an individual to supply his own bed and his own chairs. For four days

* See "Transporting a Navy Through the Jungles of Africa in War Time," by Frank J. Magee, in THE GEOGRAPHIC for October, 1922.

Photograph by Felix Shay

BREAKFAST OUT IN THE BLUE

Stopping for food and rest on the trail to Tabora, Tanganyika, after a march before dawn. Tanganyika, one of the territories over which Great Britain holds mandate by virtue of the Versailles Treaty, was formerly German East Africa. The wise traveler with a safari starts early in the morning and allows a long rest period at noon. In the background is a baobab tree (see also page 231).

we wrecked his home management and his official schedule. We ate his food and used his boys. Actually, he pretended that he liked it.

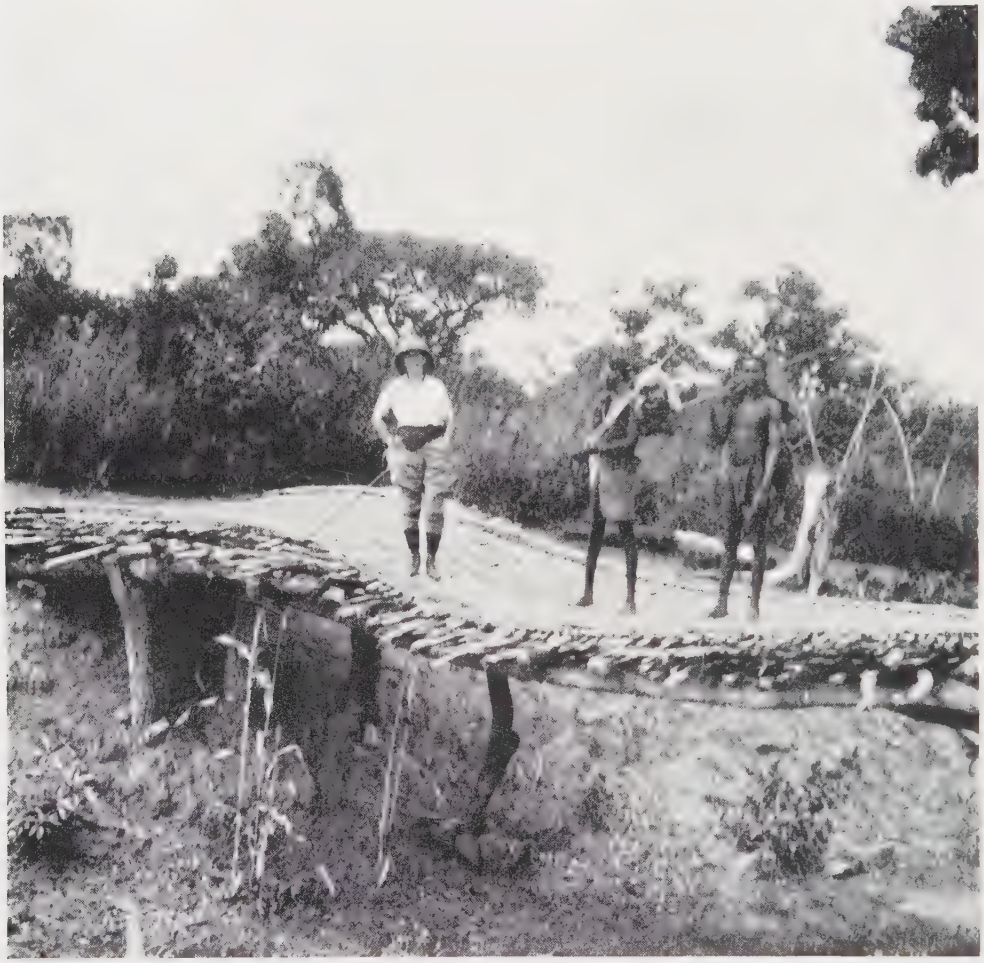
We arrived on Saturday; Sunday was a day of rest, and on Monday I paid my official call on the high commissioner and asked him to provide me with 24 carriers for the journey to Tabora. They reported to me promptly on the fourth day, early in the morning.

We lined them up and assigned the proper loads.

The Americanized English officer gave the blacks a lecture on what would happen to them if anything went wrong with that particular safari. Certainly he frightened them.

We bought each of the boys a yard of clean muslin to make them presentable. Then we selected four personal "maids" from the lot. Invariably we chose the younger boys as personal attendants, but it is no easy task to pick four sightly ones from a group of nearly naked savages.

As a last word, before we started, the top police officer, an Englishman, joined the group and added a few well-chosen threats as to what he would do to the



Photograph by Felix Shay

CROSSING A NATIVE WOVEN BRIDGE

Heavy woven matting has been laid on logs supported by piles. Sometimes the space between the piles is filled with sticks, grass, stones, and mud, leaving only occasional openings for water flow. Fish-baskets are placed in the intervals to make the bridge provide food as well as save natives from hungry crocodiles. Logs covered with matting bridge the gaps. Suspension bridges, using Nature's rope—twisted grapevinelike strands—are sometimes swung between convenient trees.

carrier who presumed to desert on the march, which occasionally they do.

At a station called Shinyanga, an outpost, we were to meet a British official who had been over that particular stretch of road and who could tell us something of the distances and the possible shelters.

Then we gave the "All Up" signal and we were off for Tabora.

THROUGH LION-INFESTED HIGH GRASS

We walked out of the settlement with a very sincere feeling of friendship in our hearts for the white men of Mwanza.

The distance from Mwanza to Tabora is variously estimated. Some say 250 miles, some say 300 miles. Using the estimate of the officials at Mwanza and later that of the official at Shinyanga, plus our own when we had finished, we decided that the distance was about 250 miles. This distance we negotiated in 15 walking days, with one day of rest, or 16 days in all.

We had been warned to keep out of Tanganyika. Old-timers told us that during the World War the contending German and Allied forces were not al-

ways able to clear away their dead, so the wild animals had become man-eaters.

Much of this formerly "German East" country is high-grass land, and there are more than enough lions in it. Incidentally, the high grass protects the lions and conceals them from the traveler. One never knows when he is in danger.

When we left Mwanza we had a safari of 23 black porters, one cook, the cook's wife, two lady friends of the cook's wife, two children that belonged to somebody, an old man with white whiskers, two extra porters with a dog coop, bound south, and one more porter whom nobody seemed to know, but who just came along to be friendly. Thus there were 33 in line whenever the free cigarettes were passed out.

Photograph by Felix Shay

THE LAST PHOTOGRAPH OF SOME HATS

A short time after this picture was taken the author's safari forded a river on the trail between Mwanza and Tabora. The boy on the left thought he saw a crocodile. Splash went the hatbox into the stream. Good-bye, hats!

For the first 60 miles beyond Mwanza the Germans had built a kind of road with some cracked stone in its composition. This walking was good for us, though not so good for the porters, who preferred the soft wayside paths and short cuts through the fields.

After that first 60 miles the road became a dirt path, sometimes 15 feet, sometimes 15 inches wide.

PORTERS TRAVEL 500 MILES FOR $2.50

For long stretches the going was difficult. The sand and white dust were 6 to 12 inches deep. The African sun, which the white men say "addles one's brain," was with us daily.

The country itself was flat and rather uninteresting. The natives were courteous and childlike.

We were able to buy food in the villages at the following prices: chickens, 7 cents; eggs, 9 cents a dozen; sheep, 75 cents; goats, $1.00; firewood, 1¼ cents a load, all reckoned in shillings and pence.

These prices were supposed to obtain, but we found the average African entirely disinterested in civilized money. He would promise faithfully to bring in a goat; then, disappear and not return.

Several times I had to take a corps of my black boys and visit the local chief in

PULLING IN A CROCODILE

"On every bank we saw crocodiles sunning themselves—lazy, deliberate fellows, grotesque survivors of a prehistoric age. They were twice as large as we anticipated, and when we encountered them farther inland they stood up on really long legs and wiggled and wabbled away with considerable speed. When they were near the water they slid in with scarcely a splash" (see text, page 141).

person, select a goat and bring it back. Otherwise we had promises instead of goats.

A goat to eat is a great treat for these black carriers, and by such a reward we could show appreciation for extraordinary efforts and for cheerfulness.

Those who are interested in the American black may be interested in the names of these carriers in Africa: Jina, Ngumira, Walwa, Kwatogwa, Kiparu, Panduji, Masaga, Meyega, Masai, Malomo, Sahani, Masalu, Kabyure, Mashiba, Burugu, Musa, Mayala, Isobya, Makaranga, Kabati, Makomba, Muchafu, Pugarume, and Gombeshenji Kwidimya.

I paid these boys 7½ shillings each for the 250 miles from Mwanza to Tabora. In addition, they received an allowance of three shillings each for food for the entire journey. This was the legal wage. One must not pay more, or less, though, of course, a gratuity at the end of a journey is permissible.

These boys walked 16⅔ miles a day for 15 days, each with a load of 60 pounds on his head, and then returned over the same trail to Mwanza, a distance of some 500 miles in all, for 10½ shillings, or approximately $2.50 each.

When we reached Tabora we gave them what all called a generous tip, 3 shillings each. They were delighted.

CONVERSATION WITH PORTERS CONDUCTED WITH AN 80-WORD VOCABULARY

On this journey the cook was a Nyasaland boy, a mission boy, who spoke some English. Actually, he was a man of about 45. Most of my boys spoke some Swahili, though there were three or four different tribes represented among them.

On the march, because we were usually a couple of miles ahead or behind the safari, from my personal boy I learned to speak about 40 words of Swahili. Incidentally, I taught this 17-year-old native an equal number of words of Eng-

Photograph by K. Kittenberger

SKINNING A 19-FOOT GIRAFFE

Giraffes are rigidly protected by colonial governments (see text, page 206). Africa harbors many of the last remaining species of animals which once roamed widely in Europe and some even in North America. Notable among these remnant mammals are the giraffe and the hippopotamus. With India and the East, Africa shares the last species of elephants and rhinoceroses. The giraffe inhabits open country from the Sahara Desert south.

lish. By the time we reached Tabora we could converse volubly with this 80-word mixed vocabulary.

These savage boys were gentle, kindly, and invariably in excellent humor.

We had splendid good fortune. We not only had a singing safari, we had a song leader. This self-appointed leader would step out of line and run up and down past his mates and make a whirring sound with his lips and give an eccentric signal. Then they would break into song, usually a part-song. They were wonderful singers; it was positively inspiring.

When we reached a village ahead of the boys we would sit outside the rest-house and watch these likable scalawags come in, strutting down the road, singing as though their lungs would burst—putting on all the style they could think of to impress the local natives. They came in like an army with banners.

We surely learned to like these black boys. To be afraid of them seemed absurd. We spoke to them and ordered them about as if they were seven-year-olds. They reacted dutifully to that treatment. They required a minimum of blame and a maximum of direction and instruction.

Like all the savages whom we had met in Africa, these boys had no manual dexterity. They made a sorry job of trying to put up camp beds, chairs, and a camp table. They had to be instructed every time. Yet they all were eager to help fumble. There was no order or system to their minds.

NO FRUIT AND VILE DRINKING WATER

When they knocked off a toenail on the march, they came to us to fix it. I would pour an antiseptic on it and supply bandages. When they fell into a hole and hurt themselves, they came to Porter or me for sympathy. One sympathizes with them as one would with a child. That was what was wanted. That was what satisfied them.

Photograph by Felix Shay

KIGOMA TO UJIJI BY RICKSHA

There are no horses, no donkeys, no autos in Kigoma. But an ancient ricksha with heavy cart wheels, requiring the strength of five stalwart blacks, bore Mrs. Shay over the hills to Ujiji (see text, page 235).

On this march we found no fruit until we were within eight miles of Tabora. Tabora has felt the Arab influence, so there was fruit in that center, but not on the trail.

The water on the march was vile. Often we had to dig into the beds of dry streams to find it. One night, at the end of a hard day, we had a good deal of difficulty in obtaining any, and when we did it was thick with mud, which we were not able to boil out or disguise the taste with lime juice.

That was one phase of this African trip which induced more hardship than the sun, or insects, or the fear of wild animals.

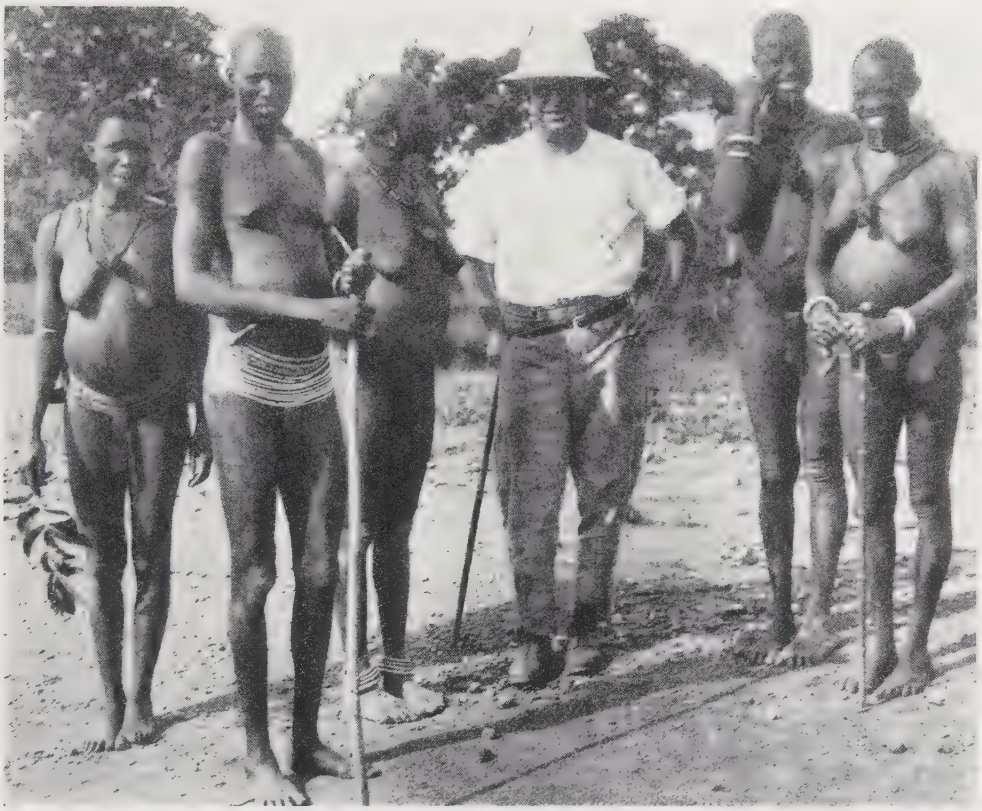
MRS. SHAY CAUSES EXCITEMENT WHEN NATIVE WOMEN DISCOVER HER

Usually at the end of a march the drinking supply was exhausted. Before one may have even a sip when he is parched, the water must be boiled. Then, of course, it is served hot. To drink scalding water when one is burning up with thirst is very unpleasant.

When we met blacks on the road they raised their hands and gave us the old Roman salute and said, "*Jambo, Bwana*" (Greetings, Master). We returned the salute and answered, "Jambo."

When we met women and they discovered that Porter, in her khaki riding trousers, shirt, and pith helmet, was a woman, they got vastly excited. They wanted her to know that they had discovered her; that she could not fool them. Usually she stopped to talk with them. They were exceedingly curious. The eternal feminine obtains in Central Africa as elsewhere.

They always wished to examine her clothes and such small ornaments as she chanced to be wearing, her watch and rings, and what not.



Photograph by Porter Shay

CENTRAL AFRICAN FEMININE BEAUTY UNADORNED

Native fashion in many districts decrees that the only apparel shall consist of breech-cloths, strings of beads, anklets and bracelets, and glass pendants perforating the lower lip.

She, in turn, I gathered, got an equivalent amount of pleasure from observing them. Usually they parted with a gift of matches.

These black women wore dozens of metal anklets, a mass of them. Several surely carried a weight of 12 to 15 pounds on each ankle. So heavy was this load that in numberless instances we observed that the foot was completely broken down.

One cannot imagine a more absurd custom among savages, who must walk every step they travel, than to break down the feet (see page 194).

Along this trail there were very few native huts. In German days (so the story goes) the Germans did not control their *askaris* (native police), who preyed on the native women wherever they found them. So native husbands took their wives far into the blue, off the trail, to escape the amorous attentions of these uniformed despots. Since the British have taken charge they have made their askaris conduct themselves as they should. The natives once again are coming back along the main trail to live; but as yet it is comparatively deserted.

Nevertheless, the ex-German district around Mwanza is one of the most productive districts in Africa. That fact seems to weaken this tale somewhat.

We saw much native cultivation, as much farming as in the Sudan, and the latter is a more fertile country.

Every hour of every day dozens of carriers passed us on the path with bags on their backs loaded with grain, taking it to Mwanza to market.

For a couple of days outside Mwanza we were still near enough to Lake Victoria to buy fresh fish from the natives, which was a much-appreciated change in the diet.

Many of the resthouses on the trail were beautiful to see. The savages build

Photograph by Porter Shay

THE AUTHOR BENEATH THE TREE WHERE STANLEY FOUND LIVINGSTONE: UJIJI

"Under the tree a scarred stone, tumbled on its side, bore the legend, 'Livingstone-Stanley, 1871.' The corner was broken off it, the edges chipped. It was foul with refuse. The stone rested, tip-tilted, thrown down carelessly, as an unwarranted obstruction in the middle of a dusty native street" (see text, page 235).

a stockade of saplings around a rest-house. These saplings take root and sprout foliage. The new green branches waved a welcome to us as we came down the road.

After we left the lake and the rocky promontories of Mwanza, we cut across a wide, open, hot plain. We walked for a steady six hours across this treeless country.

One day we passed some native royalty—a high-caste lady carried in an improvised sedan chair. She was colored, but she sought to give the impression that she was a Mohammedan. She tried to hide her face. But we laughed at her, and she dropped her veil and said, "*Jambo, Bwana.*"

All these blacks have a glorious sense of humor.

When we walked in the noon hour the heat waves flickered the landscape. The last couple of miles always required stamina.

A DIAMOND HUNTER PLAYS HOST

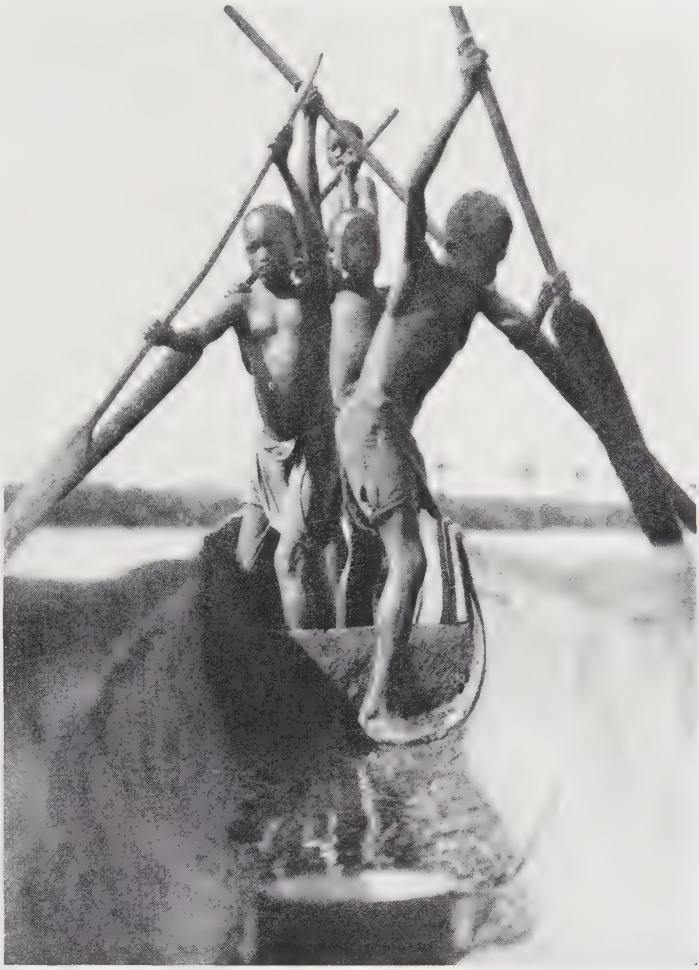
The fourth day out from Mwanza we came upon the claim of a Boer, or Afrikander, who had discovered diamonds. With the help of 100 black boys, he had made holes all over the landscape. Thus far he had found 32 scattered diamonds of sorts, but he could not find the pipe through which the precious stones had found their way to the surface. Naturally we were interested in diamonds, but we were more interested in the limitless supply of lemonade which he offered us, made from large, squashy lemons.

We sat in the shade of his hut and world-gossiped with him for an hour before we took to the trail again.

That afternoon we bought a bunch of 100 or more bananas from a black for an English sixpence. He seemed well pleased with the bargain, and so were we, because certainly no fruit grew in sight of us. These seemed to be wild bananas. They had not so much substance, were mushy, and had a core.

Whenever we passed through a native village all the blacks came out and lined the trail to cheer us on. Usually the chief wanted to shake hands with a white man. By so doing he seemed to gain prestige in his home village, and so we were glad to oblige.

Shaking hands is distinctly a white man's custom.



A CONGO CANOE WITH A FOUR-BLADE PROPELLER

Big dugout canoes on the Upper Congo are often nearly 100 feet long. They comfortably carry a white traveler amidships under a leaf canopy, 40 pack-loads, 6 porters, and 20 paddlers. While the paddlers work they sing, usually led by the steersman. Resemblance to college crew rowing is complete if another canoe appears in the river, for a furious race occurs immediately. A victory is celebrated in song the rest of the day.

THROUGH THE LAND OF THE "DOODOOS"

These blacks were not permitted to carry firearms. They were armed with spears and bows and arrows. Occasionally we saw a particularly artistic bow, or a fine, straight spear, and we attempted to buy it. After securing one or two of these objects, we gathered the impression that our English-speaking boy was *forcing* the savages to sell, because all of these articles seemed to have a uniform price of a shilling, and the black went off handling the money as though it were red-hot. He didn't quite seem to understand what the transaction was about. Therefore we stopped buying.

The day before we arrived at Shinyanga our cook-boy said we would have to start to march the next morning at 3 o'clock, because there were *doodoos*, and doodoos were fearful things. Musa's English was limited. He could not make clear to us what the doodoos were. Nevertheless, we followed his advice. I unpacked the revolver and strapped it to my belt, and at 3 a. m., in the dark, we started. The boys marched single file, while I marched outside their ranks as a kind of high corporal. They kept close together, which indicated they were fearful.

I turned over in my mind, What can "doodoos" be?

Along the dark path one of the boys fell into a hole and shrieked horribly! We certainly thought the doodoos had arrived. But up until the time we breakfasted on the trail at 6 o'clock we had seen no doodoos.

Shortly after breakfast my personal

Photograph by René A. M. Van Crombrugge

NATIVE FISHERIES AT STANLEY FALLS, NEAR STANLEYVILLE, BELGIAN CONGO

Stanley Falls consist of a series of cascades extending for about 120 miles. In the old days portages were made around the worst places. Now a railroad between Ponthierville and Stanleyville links the two great navigable stretches of the Congo River. Stanleyville is the farthest northern point now reached by continuous rail-and-river transport from Cape Town. (See the Map of Africa published as a supplement with THE GEOGRAPHIC for October, 1922.)

boy, who was a nonchalant character, slapped his chest vigorously, brought away the remains of a sleeping-sickness fly, showed it to me, and said, "Doodoo, Bwana."

For a period of hours we walked through this sleeping-sickness-fly belt. The flies swarmed around us. We were highly sensitive to their touch. The minute they lighted we shooed them off. But one of the insects bit me in the *palm* of my hand before I knew he was there.

Fortunately for me, it was not an infected fly.

The blacks, with their bare bodies, had small protection against them. We saw flies rest for limitless periods on the backs of our boys, even though the men behind attempted to slap them off. Eternal vigilance is not a savage virtue.

The black's skin is thickened by the direct rays of the sun and is not sensitive. The boys could not feel the flies until they were bitten.

One night when we reached camp, before we were decently seated, we heard the chant of many voices. Presently the local chief arrived with 400 or 500 of his men, singing. They made several giant half-circles and started an inferno of noise that would have waked the dead. They sang and danced and jumped into the air. They were giving us a sort of royal reception, but our outraged nerves could stand it for only 20 minutes. Then we presented the chief with four shillings and a package of cigarettes, told him that we were delighted with his men, and that we wanted to take a bath.

He removed them with a gesture.

This reception was accorded us on several occasions.

A rather startling proceeding was to have a whole village of blacks drop down in the dust on their knees and clap their hands vigorously in greeting. This was not applause; it was greeting.

NATIVE BOYS CATCH FISH WITH THEIR HANDS

When we came to a certain stream of flowing water, some of our boys waded in to their knees and with their bare hands proceeded to catch about 25 fish each. A boy would stand motionless over the water until a fish would swim by; then he would snatch it out of its element with his hands.

Up in the Sudan, and here in Tanganyika as well, whenever we reached water the boys took off their loin cloths and went in for a swim. Only one out of a dozen seemed able to swim. The rest simply paddled and bathed (see p. 209).

Before we reached Shinyanga we came on a group of approximately 600 native men clothed in skins, mending a hole that the rains had washed in the road, which at this point was a kind of embankment across soft, lush ground. The hole was some 40 feet deep and perhaps as wide.

These savages had made a regular carnival of fixing it. Lots of noise, lots of dancing.

While we passed through the double lines of these 600 curious savages, every man said, "Jambo, Bwana." They were a little uncertain about Porter; they did not know whether or not she was a "Bwana."

A GREAT FUTURE FOR THE LAND WHEN THE TSETSE FLY IS CONQUERED

The British officers at Mwanza told us that we must avoid sleeping inside the resthouses between there and Tabora, because of ticks. Ticks burrow into one's foot and lay eggs. The flesh festers, and since the mass must then be cut out, there is no more walking for months.

We tried Bolini's tent for one night, but found it so insufferably hot that thereafter we pitched our beds in the open. For the balance of the journey to Tabora we were cool and comfortable (and dangerously exposed to wild animals) at night.

In Central Africa the days are insufferably hot; the nights cool and often windy. Occasionally the wind blew the mosquito nets off our beds. We usually turned in at 8 o'clock and slept like the dead until 4 or 5 the next morning.

The mornings were cold. When we stopped to make breakfast on the trail, the carriers had to build a huge camp fire to keep themselves warm. They sat around it and shivered.

This was a lion country. We saw skins of them everywhere among the natives. Often we heard hyenas and jackals and lions near by at night.

"I'VE GOT THE CONGO GIGGLES"

The young soloist is supported by a solemn quartet of Central African playmates.

The country we were passing through was impressively fertile; the soil rich and black. One day the bush that protects the sleeping-sickness fly will be burned off Africa. Railways will be driven through, plantations will be opened up, and a new source of tremendous wealth will be available to the world.

Authorities say the lack of water is a serious drawback, yet for three or four months of the year this country is flooded with water. Surely this can be conserved for the dry season.

At different times on the march several of our safari developed fever, probably due to contaminated water. We dosed them liberally with quinine. They all recovered promptly except one woman, who whined and was miserable.

These blacks lived exclusively on peanuts and durra flour, fortified with a kind of starchy nut and a small sour apple, both found along the trail.

We passed hundreds of huge baobab trees, 60 feet or more in circumference, with gigantic trunks and stunted, twisted limbs. These trees were weird and ghostlike (see pages 211 and 231).

PYGMIES PASS AND SALUTE

Because of the swampy nature of the ground in places and the high-water mark left by streams in the freshet season, we concluded that this section must be impassable in the rains. The signs all told the story. Luckily the rains had passed over us farther up country.

One day we fell in with a group of

HAIRDRESSING IN A CONGO BEAUTY PARLOR

Pygmies. There were about 40 of them, all men, about 4 feet tall. They were well set up, with well-knit bodies and showy muscles, and carried themselves erect and with dignity. Most of them had beards with two sharp forks. I understood that they were very timid individuals and expected to see them dart into the underbrush. Instead, they came along in good order and saluted us, and we saluted them. But we did not have the audacity to try to take their pictures. Besides, they came on us unexpectedly. We were walking through them before we realized they were not ordinary blacks.

We saw many ant hills in Central Africa which were 10 feet or more high. Huge armies of driver ants crossed the trail and made well-defined boulevards. Through these furrows they hurried in an endless stream, bound somewhere on important business. We stopped and watched them come and go. They observed traffic regulations. There were no jaywalkers.

Along the roadside were gorgeous purple hollyhocks, the blooms of which were larger and the petals more numerous than those we grow in America. There were morning-glories in pinkish-white profusion.

Our boys carried numberless noise-making instruments, including a dozen different varieties of horns and drums. When the horns were blowing and the tom-toms thrumming and thirty voices were lifted up to the sky, there was a tremendous volume of sound.

These wild voices have a remarkable range and a wonderful quality.

The native chiefs usually walked up the path a short distance to greet our incoming train. Invariably they wore some white man's cast-off garment, oftentimes only a coat. This was for distinction and to impress us. We did our best to be impressed.

Before we had accomplished half the distance the uninvited black women became very tired, which seemed a curious phenomenon to us. They were a drag and a responsibility. We were not at all

PLAYING A GAME POPULAR FROM THE CAPE TO CAIRO

Soombi and Okwe are two of the many names for a game almost universal in Africa. The playing board has from 10 to 20 holes on a side. Counters are seeds and the victor may eat his winnings. The game has many points in common with checkers and chess and is a favorite with elderly men. Quarrels often occur between players. Then the tribal chief may prohibit the game—for a time.

expert walkers, yet we found it easy to tire these blacks. They had no staying qualities.

THE AUTHOR GETS A REPUTATION AS WITCH DOCTOR

The last third of the journey it was rather a task to hold the boys to the daily schedule of 16 miles plus, so we resorted to all kinds of tricks and subterfuges.

From the fakirs in India we learned much so-called "magic." When we stopped for a rest along the trail, to take their minds off themselves, I would show my black boys some "magic tricks" which absolutely astounded them. After these tricks they addressed me by the Swahili name for witch doctor, Bwana Mchawi! (see illustration, page 178).

What was more important, they spread the news through the villages as we passed that I was a witch doctor. Thereafter each night, when we finished dinner, practically a whole village would be in attendance, waiting for me to perform "magic."

To get rid of the audience, I usually had to do one or two simple "magic" tricks, marvelous to these savage eyes. Invariably after one of these performances the chief would send us some kind of a gift.

One day when we marched into camp we found a very rough-and-ready safari there ahead of us. It did not look like a white man's safari, and yet it did; the equipment was much the worse for wear.

A GOLD PROSPECTOR FOR HALF A CENTURY

Presently there arrived an individual, carried in a rude chair on the shoulders of four blacks. He was an 80-year-old Swede, a gold prospector.

A gold miner, no; a gold prospector, yes!

He addressed us as fellow-miners and old inhabitants and inquired about Jones and Smith and Jenkins and Clark at Mwanza.

Then he said, "Have you heard about the rush?"

We thought he said "Russ." We

THE NATIVE HUTS OF MINERS IN ELIZABETHVILLE, BELGIAN CONGO

During the World War Elizabethville enjoyed great prosperity on account of the copper mines in the vicinity, which employed thousands of blacks and enough white men to keep them in order. These huts have corrugated iron walls and thatched roofs.

thought that England had recognized Russia. But he did not mean Russ. He meant a *gold rush*. It seems he was participating in a gold rush.

For more than a score of years he had roamed in Australia, for 16 years in Bolivia, and for 11 in Africa, hunting for gold. This time he was positive he would find it.

He had mild blue eyes and he was a gentleman.

We led him to believe we would participate in the rush a little later, but he was sure we would miss the principal doings if we did not get there quickly. Where it was we did not discover.

He had luncheon with us and then moved north, while we moved south.

One must never depend on the native blacks, nor on the headmen along the road for directions. One must have a kind of schedule and hold to it. One's own boys will give misinformation purposely, and so confuse the traveler, in order to cause a rest for a day at an attractive village.

We did our best to establish an inflexible schedule.

Sometimes it was rather difficult to get the boys to move off promptly in the morning, though there were usually three or four willing ones to help make the start.

OVER THE ROAD OF A THOUSAND LIONS

Toward the end of the journey my fever gave me much trouble. Every night I had it when the sun went down.

The boys became tired and the women more than tired. They showed blisters and complained of sore feet.

At a stop called Tindi, early one morning, after we had walked about an hour, they tried to prevail upon me that this was the destination, while I knew instinctively it was not. Kiguhumu was that day's objective. Then things happened. Food couldn't be cooked. No wood or water came from the village. Boys got lost. There were a thousand and one excuses.

I hailed Musa, the cook, up in front of

my chair and said, "No matter how long we delay here, we walk to Kiguhumu to-day."

Walk we did—across an alkaline plain, or what tasted like one—a hot, low country. This was the worst we had experienced since we left the great desert. Not a breeze blew. We seemed to walk on dead air. Scrub bushes and a hot, sandy road. How those blacks suffered and wilted. Every hour we had to rest for half an hour. We arrived finally, at 5 p. m., though we had covered only 14 miles that day.

I shall always think of that trail through the scrub as the Road of a Thousand Lions. That soft sand road had as many lion tracks in it as native tracks. The boys closed in fearfully, walked on one another's heels, and called to me perpetually "Simba (Lion), Bwana"! I got out my inadequate revolver. But no lions attacked. Mice and weaselike animals helped maintain the tension, darting across the path. But no lions. Even so, one had the uncomfortable feeling that we were being watched from the scrubby bushes and high grass, through which we pushed, by animals that had us at their mercy.

"OLYMPIC GAMES" HELP TO REVIVE SAVAGE MORALE

The next day we marched 12 miles. When we arrived at the resthouse, the boys were so tired they dropped their loads and fell asleep, each man by his load, without even seeking shade. When an African sleeps before he eats he is tired indeed.

I knew that something must be done, but I wondered what. Then inspiration came to me. Paradoxically, I decided to hold Olympic games. These blacks have no other diversion than singing and dancing. I had a bag of new English copper pennies in my kit. When the cool of the evening came and the boys arose from their coma, we introduced them to the broad jump, the three-legged race, the 100-yard dash, and sundry other contests. We offered bright copper pennies as first prizes.

The boys participated with newborn enthusiasm. We had two hours of roaring, glorious Olympian sport, during which the participants forgot they were tired. I distributed as many as 25 copper cents as medals, some of them to savage gentlemen with long black beards, the grandfathers of families, for outdoing their fellows in sprightly sport.

One day I learned something of the ability of these boys as trackers. We had walked down the trail for almost two hours and traveled, say, six miles from the resthouse, when I discovered that I had lost my only piece of jewelry, an Eastern ring of rather unique design. I called three of the most intelligent boys together and explained the situation to them. I offered them a shilling each to return over the trail, and three shillings extra to the man who found the ring.

That was at 7 o'clock in the morning. At 2 in the afternoon they came into the clearing of the next resthouse and handed me the ring.

Mind, these boys had not stolen this ring in the first place; they were not thieves. I had wrapped the ring in a handkerchief that morning when we started on the march, behind the safari. Somewhere over a stretch of six miles, I had taken out the handkerchief and accidentally dropped the ring.

In that six miles we crossed all kinds of uneven, ragged country. Many times we had been off the proper trail.

Perhaps finding the ring was luck, but it was very impressive to me.

When we bought these boys a goat they dismembered it, shared it, and carried it with them for days, exposed to the sun, till it became a glassy blue and covered with flies. They carried chickens tied to their belts, head down, until peremptorily we ordered the fowls killed.

Every night these blacks crooned themselves (and us) to sleep.

The nights were spooky dark, cloudy, with an eerie moon. The stars usually were clouded over or very, very faint, not at all like Egyptian skies.

The drums, far and near, talked all night.

MRS. SHAY TRIES TO MAKE TOTO WASH

The boys had no soap and no understanding of its use. They bathed in water only when we reached a running stream, and such were few. Our camp smelled like a circus.

Photograph by Felix Shay

AN ANT HILL ON THE GOLF COURSE AT ELIZABETHVILLE: BELGIAN CONGO

The Elizabethville Golf Club consists of a small one-room shack and lots of scenery. On the course are some 600 ant hills, which make difficult hazards. Some of these giant mounds are used as garages (see text, page 246).

Porter undertook to clean up our personal boys, particularly her "Toto." They thought it was great fun. She would give a boy water and soap and tell him to wash his ears. He washed his ears and nothing else.

All these six-foot bewhiskered blacks called her "Mamma." For a five-foot woman, with young ideas, to be called "Mamma" by these huge blacks seemed to her rather an outrage. She ordered them about, gave them tasks to perform, dosed them with quinine, and treated these ferocious children with the utmost unconcern.

They also called her "Bwana Dogo," which means in the Swahili language "a little, a very little, a morsel, a crumb."

When one of the gay wenches was ill with fever she offered small resistance. She was a wreck. She had lost her social instinct. She had taken the fancy plugs out of her ears. She whined all day.

We recommend to travelers in Africa that they do not include black women in their safaris. They are the cause of much trouble and annoyance.

One night we gave the boys permission for a big dance. We brought out our chairs to watch them. They appreciated an audience. They built an extra-large fire and all of them, including the women,

A CORN-ON-THE-COB FEAST IN RHODESIA

In Rhodesia there is practically no wild fruit; so, when a missionary wished to describe Christian and Faithful, in "Pilgrim's Progress," living on the fruit of the land, he depicted them sitting on their heels munching large ears of corn, "mealies," as they are called in South Africa. Corn is a staple food of millions of African natives and in some places three crops grow each year.

got into the semicircle. A leader placed himself in front and chanted; they all replied. A short verse and chorus. They jumped up and down and sang, shouted, and danced. It was neither artistic nor amusing.

When they became quite excited I called a halt. To gain time, I lined them up and passed out cigarettes. Several dozen or more village natives had joined the dance, and so they were the recipients of cigarettes, too. One black standing off by himself received a cigarette and immediately thought it necessary to repay me, so he joined the dance.

When he came into the circle the erstwhile leader gave way and the new black took charge; evidently he was of some importance. At once he started to do a jackknife dance, throwing both his feet up against his face. He repeated this mild exercise about 100 times, until he was streaming with perspiration.

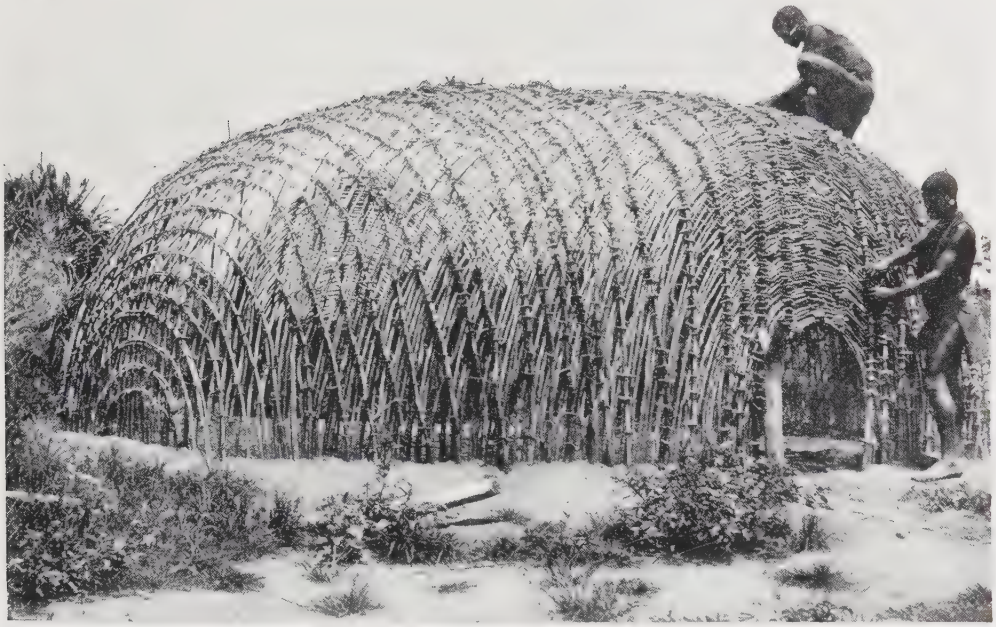
Then in a fine frenzy he went over to the great fire and took out blazing sticks two or three inches in diameter and proceeded to eat the fire off them and blow smoke with his mouth full of hot coals. How the gentleman accomplished this delicate task we cannot explain. We only know we saw him do it.

Often the grass along the trail was 12 feet high and so thick that one could not see three feet into it.

We found that we were rarely very hungry after these marches, but we were parched with thirst. Tinned Hawaiian pineapple was the most satisfying delicacy imaginable under these circumstances. Unfortunately, we had only half a dozen tins with us on this march.

Early one morning a huge snake dropped out of a tree in front of us on the path and glided into the bush, leaving a trail six inches wide. We were ahead with our personal boys. They would not go in with us; they were afraid; so we waited for the safari to come along to get the revolver. Then three adventuresome spirits joined us and we went in after the snake. While we looked on the ground, we noticed the natives looked up into the trees. We did not find it.

Once we bought two beautiful tom-



Photograph from Albert Smith

HOUSE COMPLETE IN ZULULAND, SEVEN DOLLARS

Finishing touches are being put on the framework of a Zulu house in Natal. After the men have finished tying in saplings, women will lay on the grass thatch. When the cooking fire in the center has sooted up the roof sufficiently, the thatch will not leak.

toms from a savage. They stood about two feet high. The workmanship was crude and bizarre. He asked two shillings for both of them. My boys protested loudly. One shilling for the drums, they indicated, would be enough. When I gave him three shillings, my boys were disgusted with me.

A SIKH IN THE RÔLE OF GOOD SAMARITAN

The blacks in the villages we passed through slept on the ground, inside stockades at night, under grass shelters, like animals. Along this trail they knew nothing about the gentle art of personal cleanliness, because primarily there was little water. Their fare was so simple one could not understand how they lived on it. They did not eat meals at regular intervals; they ate when they were hungry. Whenever food was plentiful they ate until they were gorged. We saw dozens of spindle-legged six-year-old infants, the pets of their families, with their stomachs so distended that they were horrible to the eye.

The day before we arrived at Tabora was the hardest of the trip. We started late because the headman at Izikizia and Musa, the cook, had agreed that we had only three hours to walk. We started at 7 a. m. We walked easily. When noontime came, with no resthouse in sight, we waited for the safari to come up. I said, "Well, Musa, where is the resthouse?"

Musa replied sullenly, "I think that sultan, he big liar."

The sun was hot, terrifically hot, especially in the middle of the day. The principal effect it had on us was to make us quarrelsome. That day it punished us severely.

We reached the village of Kazema about 1 o'clock, in the glare of the noonday sun.

We were so completely spent that we rested in the center of the village for an hour, in the shade, before we attempted to go to the resthouse, 100 yards away.

Here we were the recipients of a thoughtful act of courtesy on the part of

a Sikh, a solitary East Indian, who owned a very, very poor store there. When he saw that we were whites, and that we were exhausted, though he could not speak a word of English, he voluntarily brought us tea and sweet cakes—and some ripe papaws, which were very refreshing. He refused absolutely to take money for his gift.

The next morning I presented him with my camp chairs and camp table. He was particularly delighted with the gift because it came from a white man in the presence of the village natives.

That last morning we had an easy nine-mile walk into Tabora. We started on tea and nothing else, as the cook's box was empty. We passed through avenues of banana palms. Our boys solicited the gaping natives for bananas, but they were so busy being curious about us they had no time to look. They continually answered, "Apana" (No). Inasmuch as bananas seemed the most desirable things in the whole world just then, I am afraid that we were not equally interested in the natives.

Instead, we discussed what we would drink, and all we would drink, when we arrived at Tabora. Porter promised herself a gallon of lemonade made with clean club soda, while I said I would have a couple of the largest bottles of German beer procurable. The hotel in Tabora (in British territory) still answered to the name of "Kaiserhof," so I figured I would not be disappointed. Nor was I.

IN TABORA, WHERE THE ARABS RESTED THEIR SLAVES

After a bath and a change into civilized clothing in Tabora I lined up my boys and paid them off. I shall always remember them gratefully. They were a cheerful, likable crowd. One boy in particular we wanted to take with us. We disliked the idea of sending him back into the jungle—a 17-year-old boy who promised better things than being a savage.

That not being possible, we contributed 16 shillings to enable him to buy a particular native belle for a wife, to console his old age.

The word Tabora means "The Resting Place." There the Arabs, en route to the seaport of Zanzibar, rested their slaves captured in the Congo.

There was an influenza epidemic raging when we arrived at Tabora, and we feared we might be refused admission to the Congo. All of these African provinces, especially those under different governments, are suspicious; they tell incredulous tales about each other, and all epidemics are supposed to come from the *neighboring* states. Eventually, a certain friendly British official, together with a letter of introduction which we carried from Lord Leverhulme, fixed it, so there was no delay at the Congo border.

In Tabora Henry M. Stanley fought one of his battles. There is many a black here who threw a spear at that explorer.

A SULTAN ENTERTAINS WITH A DANCE BY 50 WOMEN

The present sultan, the son of the old chief who fought Stanley, entertained us at tea, and for our edification more than 50 of his young women danced. Each one had a bright new red tablecloth to wrap around herself in honor of the occasion. They sang in shrill voices and shuffled in an endless circle, until our eyes grew weary of the patterns on the red cloths. The entertainment was given inside the sultan's walled garden, outside Tabora.

There were a number of Europeans in the town and quite a settlement of Hindus, traders, and shopkeepers, who constitute the most important problem of Central Africa to-day.

Then there were the Arabs, who have been in and around Tabora for hundreds of years. The Arabs had well-marked slave trails through this country for a thousand years before the white European adventurers arrived.

This fact somewhat changed our conception of the hardships endured, the hazards surmounted, by the earlier white adventurers and explorers. Africa presumably has been a maze of native paths for centuries. To make progress, one need only follow the paths and endure.

After our observations in Kenya, and again in Tabora and vicinity, we were impressed with the fact that under present-day conditions this Central African country offers small opportunity to the individual settler. He is quickly starved out. Only governmental enterprise or undertakings backed by corporations with

A BAOBAB TREE 86½ FEET IN CIRCUMFERENCE: VICTORIA FALLS

Though not exceptionally tall, the gouty trunk of the baobab sometimes attains a diameter of as much as 30 feet. Its blossoms have waxy, white petals hanging straight down by a threadlike stalk. Its "calabash," or gourd fruit, resembling a coconut in shape and containing a thirst-quenching, watery pith, is sometimes called monkey bread. Baobabs grow throughout Central Africa.

limitless capital seem to have a chance to succeed.

In Kenya many of the individual settlers have deserted their plantations and come in to Nairobi, hoping to secure any kind of paying job. In Tanganyika Territory the individual German settlers have all been deported and new settlers have not yet arrived.

To conquer this wilderness requires a community of action.

In Tabora we saw definite traces of the Arab influence. There were trees of exotic fruits and many of the luxuries dear to the Arab world.

The Arab, in a comfortable mood, was very much a gentleman. He lived as such. The Arab, hunting slaves, was cruel and heartless. He invaded the jungles, captured the blacks where he found them, separated families, tied the unfortunate creatures together in gangs, and hustled

Photograph from Gardiner F. Williams

VICTORIA FALLS, ON THE CAPE-TO-CAIRO RAILWAY (SEE ALSO PAGES 172 AND 173)

It was the wish of Cecil John Rhodes, pioneer planner, that the traveler from the tip to the toe in Africa should come away with the memory of the mist wet on his lips from Africa's greatest waterfall. A spidery bridge balanced above the gorge of Victoria Falls realizes that dream. The great cataract of the Zambezi River is 1,642 miles from Cape Town by rail. Bukama, the present South-African-system railhead farthest north from Cape Town, is 928 miles beyond the falls. Although this stretch almost equals the United States' shortest transcontinental rail route, yet it is less than half the projected Cape-to-Cairo route. Victoria Falls, discovered by David Livingstone in 1855, are more than a mile wide and vary in height from 256 to 343 feet (see text, page 251).

them off to the coast under the whip. They never returned.

These flagrant slave raids brought Livingstone to Ujiji, a short distance to the west, and Stanley ultimately to find Livingstone.

A HOTEL PROPRIETOR IN THE RÔLE OF PHILOSOPHER AND PHILANTHROPIST

Disinterested persons told us the gentleman who operated the Kaiserhof Hotel lost double his overhead expenses each month. He was a Greek, a philanthropist and a philosopher as well. All in Tabora spoke well of him. He deserved it. We shall always remember him as a kindly, generous-spirited man, who sought to make his hotel something more than a halting place in a country of discomforts.

One of the British majors in Tabora invited us to his home to dine with certain of his associates. There we observed a splendid example of how the Britisher upholds civilization in the jungle. Once seated at his dining table, with its linen and silver and fine glassware, well-cooked food, and excellent service, one might have been dining in London.

We were amused by a yarn one of the officers told us at dinner: "The way to catch a lion is to catch him by the tail, and, catlike, he will try to pull away. Then, when he is pulling and straining, have some one come up and spear him.

"That is the way the natives do it. Try it on your house cat. If the theory is correct, then try it on a lion."

We promised to try it on the very next lion we met.

A VISIT TO THE WHITE FATHERS

Sunday afternoon we called on the White Fathers. The bishop in charge received and entertained us. These White Fathers come out to Africa as volunteers for life. Other white men go home on a vacation once in a year, or once in two years, but the White Fathers stay till they die. Men of all faiths in Africa speak well of them and their work.

The bishop had served 28 years with only one trip home. Once, 20 years before, after recurring attacks of the deadly black-water fever, they carried him back to Europe on a stretcher.

This dreaded black-water fever usually follows a succession of attacks of the ordinary malarial fever. Those who contract it rarely survive.

The head house of the White Fathers in Tabora was a bare and barren place inside, but outside a bower of growing things. Here they most emphatically disproved the theory that this or that cannot be grown successfully in equatorial Africa. The bishop pointed out 17 kinds of roses in a country which the armchair agriculturists say "will grow nothing." All the flowers, and dates, mangoes, papaws, oranges, pineapples, coconuts, lemons, and goodness knows what not, were there in profusion.

Behind the main buildings was located the most tragic settlement one ever cast eyes upon—the incurables, isolated in grass huts, waiting to die. Most of them were women, with all the horrible diseases imaginable, including leprosy. Some were very close to death as we viewed them.

THE RIBS OF AFRICA'S IMPERFECT RAILROAD SKELETON

Sixty-seven people are said to have been killed by lions in the Tabora district during the same year that we walked from Mwanza to Tabora. The preceding six months, bounty had been paid on the carcasses of more than 300 lions and 800 leopards. Elephants and elands had played havoc with native crops. One elephant can ruin a banana plantation in one night. These were the grim statistics that lurked behind the adventure of our walk.

From Tabora we traveled to Kigoma on the Dar-es Salaam railway, which operates from the seacoast to Lake Tanganyika. This railway and the line from Mombasa inland to Lake Victoria are two ribs of a most imperfect skeleton. Rhodes' imaginary north-and-south All-Red Route was to be the spinal column. The Belgians have another broken rib reaching in through the Congo toward the same missing backbone.

When we left, the Tabora majors and their friends, the hotel proprietor, and, lastly, the bishop of the White Fathers, came down to the station to say good-bye and good luck. The bishop presented us with a snapshot of himself.

Photograph from Gardiner F. Williams

THE TOMB OF CECIL RHODES, WHOSE DREAM IT WAS TO ESTABLISH THE CAPE-TO-CAIRO ROUTE (SEE TEXT, PAGE 251)

The man who did so much to mold South Africa's development chose the site of his own grave on a granite peak in the Matopo Hills of Southern Rhodesia. The tomb, carved out of solid rock, commands what Rhodes called the "World's View." Near him, in a similar rock-cut tomb, lies Leander Starr Jameson, "Dr. Jim," his lifelong associate and friend.

A trader in Tabora told us that the country roundabout had not been prosperous since the railway was completed in German days. The only prosperity German East Africa had ever known was while there was a railway-construction pay roll. Now all signs and portents indicated that the railway itself was a poorly paying proposition.

The hour or two that remained of daylight showed us only barren hills; when we awoke at daybreak, a ragged country of hills and valleys, an overgrown jungle. This was the country Stanley marched through to find Dr. David Livingstone. Of course, Livingstone was not lost. When Stanley "found" him at Ujiji, the self-sacrificing missionary refused to return.

Livingstone dedicated and gave his life to the blacks. He spent some 33 years in the African interior and died out there two years after the Stanley episode.

An hour before we arrived at Kigoma we caught sight of Lake Tanganyika. Livingstone made his headquarters on the shores of this lake, fighting his fight against the Arab chieftain Tippoo Tib and his slave raiders.

The jet-black natives at Kigoma were of a much more primitive mold than the breed at Tabora. Not all Negroes in Africa are black; several tribes are dark-brown and light-brown.

These Tanganyika natives indulge a distinctive vice. They snuff a hot-stuff solution up the nostrils, then fasten a pair of wooden tweezers on the nose, so none of it escapes. While they wear the tweezers, blinding tears stream from their eyes.

A RIDE TO UJIJI IN A RICKSHA

A dozen of the dark citizens put our bags and boxes on their heads and delivered us to the little Hotel Tanganyika.

These African hotels are unique institutions.

There's a building with two public rooms, and a barroom and a dining room operated as one. Beyond, adobe huts provide sleeping accommodations. One gets a complete hut for his own light housekeeping. Black boys bring water for the baths from the near-by lake. Washing is done in the back yard while one waits. There is good-enough food, better company, cold drinks, and a porch deep with shade that dominates Lake Tanganyika. What more could one ask for?

At sundown all the white men within walking distance come in for a "sundowner." It is considered unwise in Africa to drink alcoholic beverages before the sun sets. These soldiers of fortune roll dice for drinks uproariously on the hotel porch.

An Englishman whom we chanced to meet invited us to play tennis. Wherever there are English on the earth's surface, there they have grubbed out a kind of tennis court. Practically all of the English fellows we met in Africa were thoughtful and considerate. Many of them were exceptionally fine.

Along the lake, five miles from Kigoma, is Ujiji. The mango tree under which Stanley met Livingstone still stands (see text, page 218).

There were no horses, no donkeys, no autos in Kigoma. But, ah, there was an ancient ricksha, with heavy cart wheels. This Porter appropriated; I walked. It required the strength of five stalwart blacks to transport the 110-pound lady over the hills to Ujiji (see page 216).

ON THE SPOT WHERE STANLEY MET LIVINGSTONE

Ujiji appeared to be a university town in mud, with shady dim streets.

The Arab and his blood influence are still there. We passed mud mosques where Mohammedan prayers were being chanted by the faithful of many hues and shades. For all his sins, the Arab is one of the strongest and brainiest individuals the world ever produced. Show me a black boy in Africa with one per cent Arab blood in his veins and I will show you one who is smarter than his fellows.

Old Arabs in doorways stood and saluted us and we saluted them.

Here, as elsewhere, the Arab is an anachronism.

Nothing is changed, except that the lake has receded 100 yards from the old mango tree, which was directly on the shore when Stanley and Livingstone conferred under its dense foliage.

The tree was dying of bugs and neglect. Under it a scarred stone, tumbled on its side, bore the legend, "Livingstone-Stanley, 1871." The corner was broken off it, the edges chipped. It was foul with refuse. The stone rested, tiptilted, thrown down carelessly, as an unwarranted obstruction in the middle of a dusty native street.

No fence around the tree, or stone; no protection or care given to either. Yet there was an English "government house" in Ujiji. Such sights are inexplicable.

We photographed the tree and the stone, and included one of a group of naked little black boys (see illustration, page 218). He came when called, fearlessly, and departed unharmed, largely because of the life Livingstone lived and the death he died.

We expected the boat to arrive at Kigoma next morning to take us to Albertville on the Congo side of the lake, but it did not arrive until late evening. African boats make a specialty of being from two hours to two weeks or two months late. Unless the gods are good, the traveler sits on the edge of a fever river or lake and waits, and waits—and waits.

Late that afternoon a band of natives brought in a gigantic leopard and a black-maned lion, both dead. A licensed native hunter had killed them near by, where they had been terrorizing a village. Up behind the hotel the natives made a celebration of skinning them. We could have bought this beautiful leopard skin for $5.00, but it was uncured and we were on the move.

Once aboard the Belgian boat, we found the week's wash strung about the deck and the officers themselves in carpet slippers and suspenders. The wives of officers of various grades travel on these boats. We elected to return and dine on shore and only to sleep on board.

It is a night's ride across Tanganyika; we reached Albertville, in the Congo, at daybreak.

Photograph by the Rev. Arthur J. Orner

THE BROWN MAHOGANY TREE OF SOUTHERN RHODESIA

Silinda forest, although covering a small area, has a number of trees found nowhere else in the world. The brown mahogany is peculiar to it. This specimen is 165 feet tall (see also

The customs official at Albertville, it seemed, had received quantities of American cigarettes and other American favors when a soldier in the World War. He felt a personal obligation to Americans. "You are voyagers; pass on." He did not trouble to open our bags.

At Albertville we endured our first Belgian-African hotel. The only comparable establishment is an Inca Indian-kept mud shack on the shores of Lake Titicaca, in Bolivia. Each meal was interrupted while the black boys killed rats under the tables on the dirt floor. The sleeping accommodations were in vermin-infested all-grass native huts.

The only pleasant hours in Albertville were those spent at tea with the university-bred commandant and his wife.

THE CONGO WOMEN ARE THE BEAUTIES OF AFRICA

The Congo black women of this region are so voluptuous-looking as to appear almost deformed. They are brown in color, with faces tattooed in blue, and bosoms and backs decorated with raised welts. They tie their hair under their chins and around their heads flaunt gayly colored kerchiefs. Some of them wear multihued soft cotton draperies. The effect is very "Frenchy." No other blacks that we saw in Africa are so colorful or so hold the eye as these Congo women.

The Congo men are undersized nondescripts. In comparison with these opulently attractive women, the stripling men seem extremely puny.

For the first time in Africa we observed black women with shapely limbs, according to musical-comedy standards and specifications. Heretofore all legs had been fat or skinny, but shaped like poles. The Congo women had slim ankles and graceful calves.

These natives also had style; they wore their bright calicos with a swagger. Their faces were not pretty, but animated. They were alert mentally, too; they called after friends and laughed loud and long, and seemed to have much energy. They were in constant motion.

Many upcountry natives are very apathetic in comparison.

A most attractive group of brick cottages was being built in this town on two hills overlooking Lake Tanganyika. When completed, Albertville should be the model station for all Africa. The British had nothing like it in the territories we had traveled through.

It is unintelligent to expect a white man to do effective work in Africa when he is housed like a savage. Throughout the central portion of the continent, most of the Europeans live in so-called houses which are very little better than the native huts, only, of course, they are kept up better.

A nice brick house, small and comfortable, like those Albertville creations, would improve the health, the morale, and the quality of the work of the officials in Africa generally. Besides, they show the natives how the white man lives when he is at home. They teach much by example.

At tea the commandant asked: "What is a 'dee-dee' in America"?

"I do not know. Only last week I learned what a 'doodoo' in Africa is," I replied.

It was a joke in one of the American comic weeklies he wished explained. The golfer inquires, "Doctor, before I try to get this ball out of the bunker, would you mind telling me whether you are a D. D. or an M. D."?

I had the honor to explain to the Belgian.

Toward the Congo River we saw skeletons of huts, like giant rattraps, in clearings.

Some years ago an end was put to cannibalism in the Congo along the rivers and railroads, but in the interior it is said that the situation is not much changed. Two hours back in the bush one is 20,000 years back in history.

Along this route the natives are raw, the clearings few, the forest dense; living is most primitive.

THE HOTEL AT KABALO CAUSES A RETREAT

There is much sickness, plague, and what not in this Congo. Without a sufficient number of intelligent white men to fight them, the bugs and germs simply have the better of it. The insidious climate, too, is on the side of the germs.

On the train bound for Kabalo we met the Arab Sultan of Zanzibar. He was

polite and suave, with a pronounced Semitic cast of countenance.

Dark came. There were no lights on the train. We sat in the smelly car and wished for the end of the all-day journey. We stopped. "Is this Kabalo?" Nobody was sure. Somebody "thought" so.

We dropped off into the pitchy dark and impressed into our service enough blacks to carry our baggage somewhere.

The blacks led off and we followed.

Yes, this was Kabalo; there was a hotel.

The hotel man met us at the door with a lantern.

"Where are you from?"

"We are from Albertville."

"Mon Dieu! and Goodness Gracious! I had forgotten that this is the day the Albertville train is due!"

BELGIAN OFFICIALS BEWAIL LONG CONGO JOURNEY HOME

While we ate dinner we heard the whistle of the river boat, bound north for Kongolo. We were bound south, but rather than stay at this unpromising hotel we decided, on the spur of the moment, to go aboard the northbound boat and come back again.

Ten minutes after we had finished dinner we presented ourselves and our baggage to the little blond Flemish-Belgian captain, who kindly made room for us.

There were 10 or 12 Belgian officials on this boat, all bound for Europe via the Congo River and the Atlantic port of Boma. Since the World War, Belgian officials have been forbidden to go to Europe via the much more convenient way of Cape Town. At least, passage is no longer furnished them from that port.

The Belgian Government desires this passenger travel for Belgian boats; so, instead of a six days' journey from Elizabethville to the Cape, the colonial officials must travel many, many tiresome days over tortuous routes through the northern Congo.

This all-Belgic route is extremely unpopular among the officials. They take every occasion to voice their displeasure. Often, when some ordinary accident overtakes and delays them in the interior, they are 40 to 60 days en route through the Congo country.

The time distance between Kabalo and Kongolo is about six hours. We sailed at daybreak and arrived at noon.

The scene down-river was a dream of beauty. Here landscapes worthy of the art of Whistler and Corot are found, with tropical vegetation toned by one of the mighty rivers of the world.

While sailing north we sailed down. The American mind always thinks of north as "up." One travels "up" south in Africa.

Because of rapids, a boat may not navigate north of Kongolo, a settlement of sorts, with two or three stores, a few shacks for stranded Europeans, and the usual native background, on the bank of the Lualaba (the Upper Congo).

One would prefer to pass quickly over the hotel at Kongolo, but because this establishment has a contract with the boat company to furnish dinner to passengers while in port, it must be noted. Suffice it to say that, after two experimental meals, we preferred to dine on tinned sardines of uncertain age, soda crackers, and beer.

The hotel itself was an old, condemned, nearly native structure. The place was filthy. The boys who waited on the table were in ill-smelling rags. The food was nauseating. From meal to meal the butter and bread, jam and sugar, stood uncovered on an open shelf for the flies and the guests.

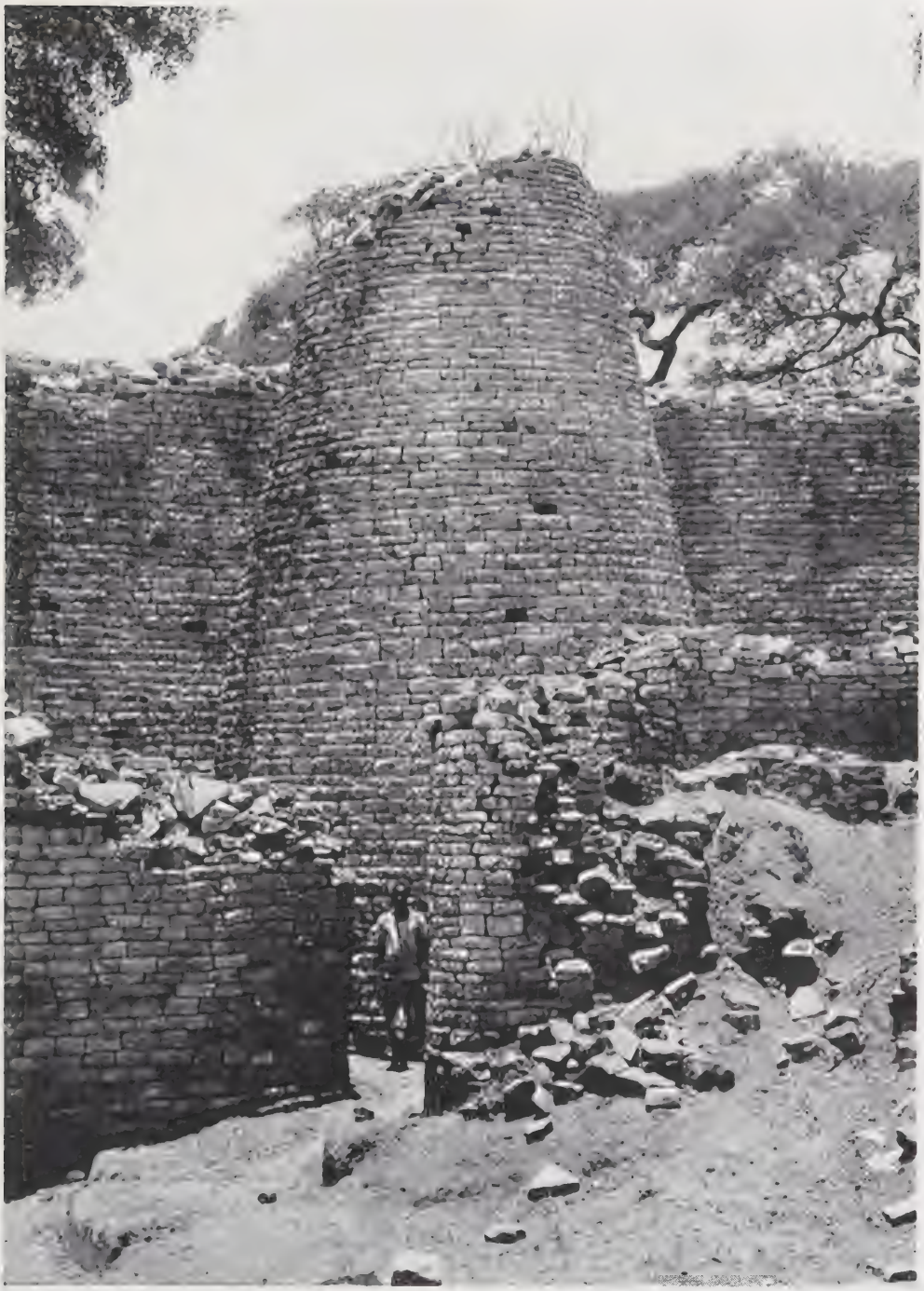
When there is a choice, one can ignore an institution of this kind. When there is no choice, the situation becomes desperate.

The Belgians in the Congo are negligent in their treatment of travelers. What is more to the point, they seem to look upon Americans and English as unwelcome guests, who may be there to exploit the country.

NIGHTS OF TORTURE AT KONGOLO

We were obliged to wait at Kongolo approximately four days and three nights before the boat sailed south for Bukama, the railhead of the South African system. These were days of torture, and torture does not describe the nights.

The sun was so intense, it was next to impossible to move about. We stayed on board and tried to sleep the days away, because at night, without a breeze blowing and the boat at anchor, the mos-



Photograph from G. H. Nutting

A TOWER OF MYSTERY IN RHODESIA

At Zimbabwe, near Bulawayo and near Cecil Rhodes' tomb, is a 30-foot conical tower of small cubes of hand-tooled granite surrounded by strewn evidences of a long-deserted settlement. The history of these ruins, as of the near-by Khami ruins (see page 251), is one of the unsolved mysteries of Africa.

quitoes wriggled through the netting and drove two more or less sane people nearly crazy. These mosquitoes were highly infectious; five minutes after these tormentors stung one, the flesh would swell and burn for an hour.

Sleep was absolutely impossible.

Occasionally the good-hearted little blond captain, at the risk of his job, invited us to a meal aboard the boat, but he dared not risk this when anyone was about. So two-thirds of our meals were out of tins and cracker boxes.

This Congo basin is disheartening. First of all, Belgium, a tiny country, is trying to organize, manage, and monopolize a vast Equatorial empire which is 77 times the size of the mother country itself. The tail is trying to wag the dog. The Belgians have neither the funds nor the men nor the experience to do it.

The men who are in the government service in the Congo are working for an insufficient wage, with despair written on their faces. They adventure out there to make their fortunes. Disillusionment comes quickly. Soon they are wondering if they will ever get back home to Europe. They quit trying to keep up appearances, which is fatal in the Tropics.

BLACK WOMEN CARRIED AS SUPERCARGO

The boat left for Bukama at 4 a. m. But long before that hour we were on the bank waiting, with all our baggage, for the first sign of life on board.

On the trip south we transported several Belgians, an Italian contractor, a couple of Greek traders, a Rumanian Jew, and a swarm of blacks.

More than one of these white gentlemen carried a black lady as supercargo. The black women were in the steerage, while the gentlemen were in the first cabins. The difference was a thin partition.

Many in the Congo openly consort with the black women. When we anchored at night—and we always stopped at night because it was unsafe to go forward in the dark—they greeted and fondled and acknowledged their half-caste children on the shore. More than one said to me, "This is my child."

At night the blacks would go ashore, build scores of little camp fires on the bank, cluster around them, and make a hubbub with their small talk.

There was no ice on board, and so each day we shot our meat from the upper deck. We would kill an antelope grazing along the bank. Then the ship would stop, a dozen blacks splash ashore and drag back the carcass, to be served for dinner. This meat is not unlike, but is inferior to, mutton—at least, as it was served to us.

We ate several varieties of horned animals in Africa. One must develop a taste for such meat.

These wild creatures were beautiful in action. When killed they proved to be vermin-covered and not pleasant to see.

THE ONLY SHOWER BATH CONVERTED INTO A STOREROOM

There was one shower bath on this boat for the several white passengers, which might seem to indicate a complication. There was no complication at all; the bathroom was used as a storage room and was not available for its ostensible service. For eight days we dipped pails of water out of the Lualaba each morning and tried to maintain our morale.

The natives were everywhere. We were obliged to pass through them, brush shoulders with them, climb over them, to get to our cabins. They carried all sorts of live animals, including goats and chickens, and a plentiful supply of well-dead meat. The odor was indescribable and unavoidable. It permeated the atmosphere by day and suffocated us at night.

One day I came out of my cabin suddenly and bumped into a native carrying the head of a goat past our door. A million flies followed. I launched a kick at him.

The same sort of boat on the Nile, under British command, was clean and shipshape and the native passengers uncontaminating quantities.

On this boat the first-class cabins were on the lower deck, among the natives. The man who designed the craft for Congo River traffic must have been a madman. At night swarms of mosquitoes distributed their favors and fevers indiscriminately between us and the blacks; passed from one to the other and back.

Photograph by Porter Shay

THE AUTHOR AND THREE MATABELE GIRLS IN KILTS (SEE TEXT, PAGE 252)

When the Matabele warriors were pacified, some 28 years ago, they became a tribe without an occupation (see text, page 249).

These blacks were covered with vermin, not excluding the women who belonged to the white men.

UNTRUSTING BARTER BETWEEN NATIVES

The Congo is the typical tropical river of the imagination, with banks bordered by high-shooting palms and gorgeous jungle. We passed conical grass huts and native villages at every turn in the stream.

One day we saw an impressive sight, a roaring grass and forest fire started by the natives to clear the land and to chase off wild animals. Intense heat waves and volumes of black smoke swept over us. The whole world seemed on fire.

When we stopped, natives on board traded bananas for fish with those on shore. One native waded out to the ship and proffered the fish. Then the banana was projected by the one on board. Both grasped the banana and the fish. At a given signal the exchange was supposed to be made. But one day a smart native on shore pulled the banana out of the hand of the native on the boat without relinquishing the fish. He decamped with both. We watched him run until the jungle hid him from view.

When we stopped at a trading post, a single shack managed by Greeks, we were treated to beer, and exchanged much gossip. When we stopped at the post where

Photograph from O. W. Barrett

WARRIORS OF A CRACK ROYAL ZULU IMPI

The shields are of a model prescribed by King Chaka. This cruel tyrant, whose people were the scourge of South Africa, said no warrior in his impis, or regiments, would wish to protect from the spear thrusts of his enemies any part of his body except the abdomen; hence the tiny shield. The Zulu is a magnificent physical type. A large percentage of the warriors are more than six feet in height and the women are almost as tall. Their color is a brownish-chocolate shade.

the Rumanian left, he presented Porter with two little otter skins. This boy had been in the country for some years. A few months previously his partner, a newcomer, while swimming in the forbidden river, was eaten before his eyes by a crocodile.

The scenery along the Congo was much more varied and much more beautiful than along the Nile, with palms and mountains, vines and valleys. There one saw the Tropics as one hopes to see them—luxuriant, gorgeous, riotous.

As we proceeded up the river, going south, there was a marked variation among the native tribes. Often when we passed a village the natives swam out to us through the crocodile-infested waters and begged for bottles.

We shot at these crocodiles from the upper deck.

One day a Belgian officer sniped one that was lying on a sand bank. The bullet seared the reptile's spinal column. The pained animal jumped fully six feet in the air before it finally took to the water.

At Mulongo a Belgian official and a company of native soldiers were attempting to quell an incipient rebellion. The Belgians had deposed an old chief who took to the hills. Once in so often he raided the villages of his successor.

The blacks were in sympathy with the "true" chief, so the Belgian officer had a job on his hands.

ELEPHANT MEAT IS ADDED TO THE ODORIFEROUS CARGO

One day we stopped at a station where a young English trader came on board. He was escorting to Elizabethville a supply of sliced elephant meat, with the tusks and the hairs of the elephants' tails as additional baggage. After a few days this elephant meat lent a new odor to the already supercharged air. The young trader gave Porter an elephant hair bracelet as a charm to placate the olfactory sense.

The natives take these heavy hairs, fully one-sixteenth of an inch in diameter, and make bracelets and rings, which are considered very ultra in Africa and mark the man of the interior.

The Belgians want the natives to come back to the river bank to make tax-collecting easier, but the natives prefer the jungles.

On occasions we passed long canoes with as many as 40 paddlers, a white man under a straw thatch. In the bow there were usually three beaters of drums. The paddlers cannot do their work unless the drums do theirs first. When we went by, the drummers put on style and the blacks shouted and redoubled their efforts.

Once when we caught up with such a canoe going south they raced us for a full mile and held their own with the steamboat, while they poured perspiration and shouted themselves hoarse.

TALKING DRUMS USED BY NATIVES

The Englishman told us numerous stories of the black folk at his station. A boy clawed by a lion was placed by his people in a canoe filled with water, and sloshed back and forth for hours. The wounded boy's head almost exploded with fever. Then he died. One black stole the Englishman's shoes and some of his equipment. The Englishman sent for a witch doctor. The blacks were lined up. The witch doctor put a little seed on the inside of the upper lid of the eye of the man he questioned. Then he commanded, "Take it." If the eye rejected the seed, the man was innocent.

When he reached the guilty man, some reaction of the nervous system turned the seed back into the eye socket. That the guilty man was guilty was proved by the fact that the stolen goods appeared on the porch of the Englishman's shack next morning.

This raconteur informed us that the African natives have talking drums. Yes, they talk. They speak the native language, not a dot-dash system. The drums actually reproduce words, he said. The average drum can be heard for 10 miles, and some of the big ones can be heard for 16 miles.

We had heard these drums all night on countless evenings out in the blue.

With drums the natives communicate with each other, according to our informant, and send the news, whatever it may be, from village to village.

After being stuck on a sand bank for 18 hours, our boat arrived at Bukama in

Photograph by Alfred S. Hart

"EYES RIGHT": A QUARTET OF KAFIR MOTHERS

time for us to miss the train going south; so we had another two and a half days' wait. Such unwished-for delays are a never-failing feature of African travel; they add much local color to the journey.

The hotel at Bukama was well managed. The place was clean, the food entirely acceptable.

After dinner the dining room was cleared for dancing. An American phonograph played "Oh, You Beautiful Doll" and "Everybody's Doing It," and other selections strictly of the pre-war period. The gentlemen paired off and danced together.

Certain of the Belgian officers were very pleasant, agreeable fellows, especially the newcomers, and those who had positions which were sufficiently remunerative—those who still had hope.

At mealtime we heard a Belgian officer rebuke a native serving boy. He said, "You Ba-luba!" The word sounded most insulting. Later, we discovered that "Baluba" was the name of the boy's tribe. The boy was both rebuked and shamefaced. It is no sport for a savage to be called a savage, particularly when he hopes he isn't.

The third night we boarded the train for Elizabethville. By this time we had exhausted our money. There were no banks from Nairobi to Elizabethville.

We had just enough to purchase two second-class tickets. But a Flemish-Belgian official of influence, with whom we had dined and danced at Bukama, placed us in a first-class compartment and overlooked the slight discrepancy in the fare.

ELIZABETHVILLE PROVIDES COMFORTS OF CIVILIZATION

When we arrived at Elizabethville, the Congo outpost of civilization, we found it necessary to borrow carriage hire from our English friend to get to the hotel.

The blacks called Stanley *Bula Matari*, the Rock-breaker, the Road-maker. They apply the same descriptive title to the Belgians as a class.

Elizabethville, named after the Queen of the Belgians, is the social and trade center for the Bula Matari in the Congo.

In Elizabethville we fraternized with the young Englishman who came from the heart of the Congo with us, and with several of his friends. We enjoyed life immoderately. This was the first vestige

A SWARM OF RHODESIAN CHILDREN

The African native thinks neither of the past nor future. His great sense of humor is a saving grace, and he is blessed with an ear for music. He will amass property, but makes little use of it to change his mode of life, beyond buying additional wives.

of civilization after many weary weeks. In Elizabethville they had ice and edible food, clean beds, and other symbols of luxury.

Here my fever blazed up again, and I applied quinine and philosophy in equal parts.

Elizabethville is a typical tropical town of wide streets, one-story houses, a few central stores and bars, a motion-picture theater, a bank or two, buildings for the officials, and such. The whole covers a tremendous area.

In these tropical towns one wears out his legs walking from the railroad station to the post office, and from the bank to the hotel. Though we walked 16 miles a day in the blue and did not object, in town we protested at the unnecessary half mile.

BRITISH AND AMERICAN ENGINEERS ARE OUSTED

Elizabethville enjoyed special prosperity during the World War period, because of some extraordinary copper mines, with gigantic smelters, in the near neighborhood. These employ thousands of blacks and enough white men to keep them in order.

Up to the present the brains in charge of these mines in the Congo have been either American or British. Since the war the Belgians have made it a definite policy to get rid of the Anglo-Saxons. Already they have succeeded in letting out 80 per cent of them. They seem to fear that the British want to take the Congo by peaceful penetration. What they fear from the Americans is more difficult to determine.

Since the war hard times have settled on the Congo, and on Elizabethville particularly. Most of the transactions in the Congo are settled with *bons-pour*. A bon-pour is the Belgian equivalent of an I O U. One accepts such a slip of paper and waits for the money. Sometimes he gets it; oftentimes not. Bankruptcy was the order of the day in Elizabethville.

We waited in Elizabethville for about five days, until the banks cabled and cabled again for money for us. These bankers in the Congo are the most suspicious men on earth; they have a right to be. Adventuresome gentlemen, in the habit of contracting obligations, leave the Congo in the dead of night without formalities.

In an effort to check such practices, the Belgians have a law to the effect that

NATURAL ROCK WALLS OF A MATABELE KRAAL IN RHODESIA

Taking advantage of a convenient rim of rocks, natives have built a village. As a further measure of precaution, they have raised a brush palisade around their huts. "Kraal," throughout South and Central Africa, means a protected village. This settlement is situated among the boulder-strewn Matopo Hills (see text, page 251).

if a gentleman wishes to leave the Congo he must first put his name on the public bulletin board for three days, to give his creditors a chance.

The next train south would not be along for some days. There was nothing to do but to stroll about, and visit, and trade yarns with our English friends.

GOLF AMONG THE ANT HILLS

We visited the Elizabethville Golf Club, consisting of a very small one-room shack and lots of scenery. On this golf course they have some six hundred ant hills. To reach a green one must learn to carom the ball off successive ant hills. We saw gigantic ant hills that were being used as garages (see page 227).

Round about Elizabethville are scrub forests and miserable clearings.

The Congo is the most wonderful metal country in the world, but the land is rough and ragged. These metal deposits are owned by a monopoly. Lone prospectors are not encouraged.

There is little chance for an individual in the Congo. The only opportunity open except for small and inconsequential trading with the natives, is to die of fever.

The Belgians here refuse to talk English. They insist that one talk French,

Photograph from P. Mitchell

THE PREMIER DIAMOND MINE, NEAR PRETORIA, TRANSVAAL

Here was found the famous Cullinan diamond in 1905, weighing one and one-half pounds. In 19 years of operation the mine yielded 22,000,000 carats of diamonds from 95,000,000 tons of earth. Excavated material is hauled by machinery to the washing plant, marked by smoke-stacks.

even when they are familiar with the English tongue. I was glad to converse in what-I-call-French. They were fittingly punished by being obliged to listen.

All blacks, of course, go barefoot. I noticed their feet were seamed and cracked, some with deep fissures. Many had sore feet. This business of being a happy, care-free savage is overadvertised.

All waiters in hotel dining rooms go barefoot. Back in civilization again, this seemed strange and somewhat unnecessary to us, but a young Englishman insisted, "I make all my boys go barefoot in the house. It saves noise."

Social clubs in the Congo, such as exist in British possessions, have difficulty in surviving because the official Belgian, once he lands, starts to counting the number of days before he will sail for home again. Therefore, when he is asked to join a club, he replies, "What is the use of joining a club when I have only 112 more days to remain here?"

They seem to have but one interest—to finish their three years, take their savings, and go back to Europe.

At the mines the officials of a certain class are entitled to a five-room house. An Englishman who was employed designed

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A MINE CAGE DESCENDING A SOUTH AFRICAN GOLD MINE

The wire screen over the cars is to protect the men from falling rocks.

a five-room house plus a bathroom. They said, "You are not entitled to a six-room house. That bathroom makes it six rooms." He answered, "A bathroom isn't a room; it is a religion!" (He got the bathroom.)

An Englishman said to me: "My little girl goes to a private school here. There the children bathe once a week. We insisted that she have a daily bath. Because we insisted, an exception was made in her favor. Now the other children think there must be something the matter with her because she has to bathe every day."

We entered Rhodesia, the most northerly of the South African states, at Sakania, approximately 150 miles southeast of Elizabethville.

AMONG THE MATABELE, MEN WITHOUT AN OCCUPATION

Rhodesia, from this station southward, is a ragged, broken, tree-covered country, tremendously rich in mineral resources. As in the Congo, concessions have been granted to powerful groups. The lone prospector is very much an outsider. Should he discover gold, diamonds, copper, when he goes to register his claim he finds the land already let to a concession.

All day, from Sakania to Broken Hill, we traveled empty, desolate country. Na-

© Publishers' Photo Service

COOKING IN THE COMPOUND AT A KIMBERLEY DIAMOND MINE

Natives who enter the employ of the mine live in the compound until their contract is up. The government gets much revenue from mining operations; diamonds alone are taxed 60 per cent.

tive kraals appeared in clusters. Occasional white settlements were usually a group of half a dozen one-story shacks. We stopped at railroad stations set out in the blue, with no houses near. Round these lone stations natives appeared in breechcloths and assorted semicivilized rags.

These natives are in an in-between period, neither savage nor civilized. They are the once-dangerous Matabele, who were on the warpath as late as 1896, when they gave Cecil Rhodes and Dr. Jim (Sir Leander Starr Jameson) a rather busy time.

After that fracas the Matabele learned the futility of war. They threw away their shields and spears and returned to their kraals, broken in spirit (see p. 246).

Among savage men, war and the preparation for war are a large part of the day's work. With no more wars in prospect, with no enemies to raid, how are the Matabele men to be employed?

Near the towns they find the odd jobs of the white man's civilization attractive, but out in the blue, where thousands of them live, what are they to do with their surplus time? To them cultivating the land is women's work, degrading work. They have never done it. No man of warrior blood will do it except under protest.

Besides, their wants are simple. Their women easily are able to grow enough for immediate family requirements, and a savage rarely lays aside anything for the future.

So, as a South African puts it, "They sit around and rot."

We saw uncounted thousands of these "rotting" natives. Many of them were huge men, with bold, strong faces, masses of coarse wool, thick bodies, and heavy,

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WIRE ENTANGLEMENTS AROUND A KIMBERLEY DIAMOND MINE

Many methods of preventing diamond thefts have been devised in South Africa. Besides having barbed wire and charged electric wire fences, mine operators keep close watch on native and white workers. The government aids by requiring all diamonds to be registered and all dealers to be licensed. It has been estimated that nearly 50 per cent of the diamonds taken out in the early days were stolen and sold secretly (see also text, page 256).

muscular legs, which distinguished them from the blacks of the tropical zones, who have slender, bowed legs.

Black men of the colder zones are strange anomalies. They have much of the vigor and courage of white men. Both the Zulus and the Matabele, who live in the South Temperate Zone, were strong and resourceful warriors—worthy foes of the white man.

They left their mark on South African history.

On the warpath these Matabele wore feathers in their hair, painted their faces, wore circlets of zebra-tail hair around their arms and just below the knees. They carried long multicolored oval shields of zebra skin, bows and poisoned arrows, and *assagais* (spears). When they attacked they arose out of nowhere in the high grass and hurled themselves on their opponents like fiends.

Broken Hill is the first white colony of importance as one travels south. Smart, fresh young Englishmen came down and promenaded the railroad platform. It was a treat to listen to them talk. They chaffed each other and exchanged familiarities with acquaintances on the train and managed to make a cheerful hour of it.

BROKEN HILL, THE FIRST IMPORTANT COLONY OF THE SOUTH

Towns like Tabora, Elizabethville, and Broken Hill are very attractive when described by soldiers of fortune, who tell a tale of glamour and romance. But oh, my friends, these towns are dull—dull!

They are simply villages existing under impossible conditions, with all the penalties of village life and few of the advantages.

The white man who can keep up his exercise, hold on to his self-respect, and maintain his sanity in a tropical village settlement deserves every man's congratulations.

"Out in the blue" is the proper phrase to describe the African country. To a slight degree it conveys to the mind a conception of the immensity of that astounding continent.

Here we saw the "blue" stretching away interminably.

A dust cloud appeared far off ahead of us. Soon a shape outlined itself. It was a prairie schooner with 16 oxen attached. A tall man, with whiskers and a slouch hat, walked alongside and cracked a 40-foot whip and shouted to the oxen. A woman and a five-year-old child were his passengers. They were going upcountry to seek their fortune.

Rhodes advised young Englishmen seeking their fortune in Africa to "go north," just as Horace Greeley advised Americans of a generation ago to "go west." They still follow Rhodes' advice.

THE GLORIES OF VICTORIA FALLS

The second day came Victoria Falls, the falls of the Zambezi River, discovered by Dr. Livingstone. These falls are broader and more than twice as high as Niagara (see illustration, page 232).

The great cataract is surrounded by masses of green trees. The country is wild and tortuous. Above the falls the Zambezi, a lazy, sluggish stream, makes haste slowly, hesitantly, blindly, till it reaches the edge of a narrow fissure in the basaltic rock. Then over it goes, headlong into the chasm. From the point where it disappears into the froth until it emerges a quiet river again, it has cut a cavernous passage through the rocks, sheer and deep.

The scenery is indescribably beautiful. We had a wonderful view of the gorge from the Victoria Falls Bridge. The mist from the cataract blows over the railroad coaches just as Rhodes wished it to.

There is more natural beauty to the Victoria Falls than to Niagara Falls, because the scenery is sylvan and undisturbed. But the water comes over in much smaller volume. For this reason there is not the terrible, majestic threat of Niagara.

The Zambezi pours itself into the gorge in several silvery streams, exquisitely proportioned like a well-planned sketch.

Bulawayo is the old capital of Lobengula, the last great chief of the Matabele. The name means the "Place of Slaughter," which suggests the gentle temperament of the old savage. "Off with his head," was Lobengula's favorite expression and the large part of his domestic policy. Thirty years ago unmitigated savagery reigned here; now Bulawayo is a presentable, orderly, civilized town.

AT THE TOMB OF CECIL RHODES

There we found a scrupulously clean English hotel; bathtubs and a plentiful supply of hot water. There we found ice cream and oranges and apples, newspapers, motion pictures, and automobiles to ride in, chocolates—and information about boats.

Rhodesia was named after Rhodes. They tell many tales of him in Bulawayo. Very little of the human man that was Rhodes is left in the glorified myth of him. His admirers want him all white, while he thought of himself as being "all red."

They have a statue of Rhodes in the very center of Bulawayo's main street. It looks toward the north.

We motored 28 miles to Rhodes' grave in the Matopo hills (see page 234).

The body rests in the tomb carved out of the solid rock, supposedly on the exact spot where Rhodes made peace with the Matabele chiefs in 1896.

The path that leads upward across the gigantic boulderlike mountain is steep and treacherous, but the top is what Rhodes once called the "World's View," a magnificent and turbulent sea of rocky ridges. The view is unobstructed on all sides. Rhodes Rock comes to a crest; the adjacent land falls away and leaves that crest supreme, alone.

The cavern hewn out of the rock, Rhodes' tomb, is covered over with a smooth copper plate, with the words engraved on it, "Here lie the remains of Cecil John Rhodes."

Thousands of near-by acres are preserved "forever" as a national cemetery and dedicated "to those who deserve well of their country."

Not far from Rhodes, Dr. Jim is buried.

Near Bulawayo, seven miles out, is another place of pilgrimage, the Khami Ruins. This prehistoric structure is sup-

posed by some antiquarians to be of Phœnician origin. Over the Khami River, on a promontory, some ancient people built a stronghold. Only stone walls remain. These are constructed with square-cut blocks, similar to modern paving stones (see also page 239).

If we accept the supposition that the ruins are of Phœnician origin, then these people came to South Africa for gold, diamonds, and copper. Numerous old diggings, old mines, are in the neighborhood.

IN THE RIDER HAGGARD COUNTRY

This is the Rider Haggard country, where he found the material for his soul-stirring tales. Near by he located "King Solomon's Mines." He made much romance from the indefinite ancient history of this curious land.

That the prehistoric people who built these Khami Ruins were a highly civilized race is proved by the exhibit in the Bulawayo Museum. There I saw gold beads, table tools, and, most interesting of all, a pair of handcuffs, such as policemen use. Immediately to one's mind handcuffs suggest law and order, and law and order imply civilization.

On close inspection this Rhodesian country is a disappointment. Of course, there are some choice bits, but much of it is dusty, rocky, raw, and barren. Here pioneer farmers have a difficult task before they can plant their crops. Much of the land is covered with shale and small stones.

One cannot deny the fact that somewhere in Rhodesia there must be crops and cattle. Bulawayo depends for its sustenance on that sort of trade. Nevertheless, when one thinks of Rhodesia, one thinks of mines.

On the return trip we met several parties of Matabele girls with huge baskets on their heads. They wore Scotch plaid kilts and shawls of Scotch plaid (see page 241).

To meet a group of these women, swinging along the road—with round, close-cropped heads, little swagger skirts, nothing much above them, stout tenpin legs, bare feet, smiling eyes, and glistening teeth—is to give one pause.

We stopped at the kraals and met and visited with old men who had fought in Lobengula's Impis (regiments).

A short time before we arrived, the voters of Rhodesia formally and officially rejected the proposition that Rhodesia should join the Union of South Africa. To an unprejudiced outsider, this did not seem to be "thinking in terms of continents."

The next stop was Mafeking, from which Dr. Jim (Jameson) started his raid, which precipitated the Boer War, and the town where Sir Robert Baden-Powell, founder of the Boy Scouts of Great Britain, and Chief Scout, endured a famous siege.

The tumult and the shouting have died; the captains and the colonels have departed. To-day in Mafeking heroism consists in producing more than one consumes.

AMONG THE BOERS OF THE VELDT

Crack! We stopped at a small station. Crack! Crack! It sounded like a high-powered rifle, but it was an ox whip, a whip for 16 oxen. A man stood in a dust cloud alongside his span of oxen. He "gee-hawed" them into line and punctuated his cries with the cartridge-like crack of his 40-foot whip.

These men were Boers, Afrikanders, Dutchmen.

Mafeking is the center of a cattle country, a farm country. The veldt was brown and beautiful. Spring was in the air.

We thought of Olive Schreiner and all that she had written about the vast and silent spaces of South Africa. Suddenly we were caught in the spell of that distinctive country.

We saw dozens of farmers, Boers, at work.

When the train stopped, natives urged on us carved-wood figures, giraffes and elephants and buffaloes, of their own crude manufacture. Other natives offered the skins of wild animals. Ostrich feathers were sold at prices which should make Parisian milliners weep.

Stolid, silent Boers stood about and said nothing—tall, lean, muscular men of Teutonic cast of countenance. They seemed resolute and tireless. Obviously

Photograph by Alfred I. Hart

SOUTH AFRICA'S VARIANT OF THE HAWAIIAN GRASS-SKIRT BALLET COSTUME

These masked native dancers are from Kentani, a district on the southeast coast of the Cape of Good Hope Province.

they belonged to this land. This they called home.

The veldt, tinted with purple heather, dipped and swelled. Peach blossoms and spring flowers were interspersed with cactus plants.

On the near horizon were the conical kopjes that protected the Boer army when it clashed with Kitchener and Lord Roberts. They lay in ridges, natural fortifications. We well remembered the frightful British losses.

The Boers hold to their racial instincts as strongly as ever. They were defeated, but not convinced. To this day they speak only Dutch among themselves. Many of them cannot speak English at all. When they surrendered to the British, they bargained for and secured the right for the Dutch language to share all privileges with the English language in South Africa. Therefore there are two official tongues. All announcements are printed in these two languages. All street signs are in two languages. That was one particular reason why Rhodesia refused to join the Union of South Africa. It wished to avoid this bilingual handicap.

IN THE CITY THAT PRODUCES HALF THE WORLD'S GOLD

Johannesburg, nearly 1,000 miles northeast of Cape Town, is situated directly over the mines that produce more than half the world's supply of gold. In days gone by they called Johannesburg "the tin town with the gold cellar." It is no longer a "tin" town. It is an impressive city.

Of course, we wanted to see the gold mines. There are certain days when they are open to the public; other days, not. This was one of the "other" days. At the Crown Mines I came in contact with the superintendent. I suggested that unless we saw the mines then, we would never see them, as we were leaving the country within a week. While we talked, who should walk into the office but the "big boss" of the underground workings. Who should the "big boss" be but an American, a Californian.

AIRING OSTRICH PLUMES AT CAPE TOWN IN PREPARATION FOR SHIPMENT

© Publishers' Photo Service

HATCHING OSTRICH EGGS ON A FARM NEAR ROBERTSON: CAPE PROVINCE

Photograph by Alan Yates

ONE OF THE WORLD'S FINEST CAPITOL BUILDINGS: PRETORIA, SOUTH AFRICA

The new government buildings of the Union of South Africa at Pretoria overlook a terraced Italian garden and the valley below. Two large wings are connected by a curving colonnade. The buildings accommodate 1,500 officials of the four provinces—Natal, Orange Free State, Cape of Good Hope, and Transvaal. South Africans apparently believe in separating the executive from the legislative in government; while Pretoria is the center of administration, Cape Town, where the legislature meets, is 1,001 miles away by rail.

Photograph by Alan Yates

LOOKING WESTWARD THROUGH ONE OF THE ARCHES OF THE UNION GOVERNMENT BUILDINGS, PRETORIA

The site of the Capitol, on a knoll about one mile beyond the center of Pretoria, has been described by Lord Selborne, formerly High Commissioner for South Africa, as "one of the finest in the world and chosen by people with courage and foresight."

THE RESIDENCE OF THE PRIME MINISTER OF THE UNION OF SOUTH AFRICA

"Groote Schuur," overlooking Table Bay, at Cape Town, was given by Cecil Rhodes for the official residence of the prime minister. It was Rhodes' home and it contains many of the possessions he prized.

"Well, Old Timer," I said to him, "now is the time for all good men to come to the aid of their party, and we are your party. We wish to go underground. We understand that you are the official fixer for unofficial Americans who have nothing to recommend them but their nationality and the purity of their purposes."

We had never been underground in a mine before, never in a cage before. This cage was a steel-box elevator, illuminated only by the miners' torches, which we carried. We were going down a mile. Cold, damp air surged up all around us. The bottom dropped out of the world on well-oiled skids. Down, down, down! At last we dropped on a cushion of air, paused, stopped.

A GOLD MINE ON 29 LEVELS

When we stepped out of the cage the "big boss" said something. I saw his lips move, but I could hear nothing. I was as deaf as a post, because of air pressure on the eardrums. I had been warned, but I had not expected total deafness. I stood there, mutely moving my jaws, rubbing behind the ears. Soon the deafness passed.

There are 29 levels to this mine—29 floors—a skyscraper upside down. Nine thousand men work underground. This one mine covers 18 square miles.

One expected to find gold nuggets protruding from the walls of the subterranean passages. One expected to find pockets of the precious metal. I had done some literary mining in my time with Sindbad the Sailor and Baron Munchausen. Imagine my surprise when I discovered that the gold in this greatest of all gold mines was not visible at all.

The stratum that contains the gold starts near the surface and points like a jagged flash of lightning toward the world's axis. This stratum of ore rock cuts through the 29 levels of this mine and enables the miners to attack the ore-bearing vein at different levels.

Presently our special train arrived. We were propped up on top of an electric dump cart, with an exposed live wire less

Photograph by Dr. Wm. T. Lawrence

TABLE BAY AND TABLE MOUNTAIN, CAPE TOWN, SOUTH AFRICA

Table Mountain, with its extension, Lion's Head, rising directly behind the town, makes this one of the beauty spots of South Africa and one of the finest harbors in all the world. "Good-bye and Good Hope" is South Africa's farewell to the departing voyager.

than a foot overhead. All the way we were supremely conscious of that wire, particularly when we whizzed round corners and it rattled on the bracket.

Black and white faces peered at us, smiled at us, through the gloom as we rushed by.

Gold was discovered in Johannesburg in 1886.

PRETORIA'S MAGNIFICENT CAPITOL GROUP

The second day in Jo-Burg we detoured to Oom Paul Kruger's old capital, Pretoria. Pretoria is 45 miles from Jo-Burg. The finest thing in all South Africa, and probably the finest group of public buildings in the world, are the Union Buildings in Pretoria (see illustration on page 255).

The Pretoria Capitol Buildings rest on a slope, a ridge over the town. They are artistically a part of the eternal hills. They have balance, proportion, dignity. What the Taj Mahal is among religious edifices, the Union Buildings are among capitols.

We paid a visit to the local cemetery, where Oom Paul stands in bronze, easing his rheumatic foot on his cane. This unromantic figure was one commander who guaranteed his men nothing—no uniforms, no food, no medals, no pay, no pensions, no benefits, no bonuses—nothing! He gave them the privilege of going out to shoot and be shot at; to die for a cause they believed in. From 14 to 80 they volunteered.

The last night in Johannesburg we visited a suburb to hear General J. C. Smuts, the Premier, speak—Smuts, who was one of Kruger's officers and who was so conspicuous a figure at the peace negotiations in Paris.

He was to address a miners' meeting. There were some 500 men seated in the hall when we arrived. As the evening progressed, another 500 stood behind the last rows of benches or draped themselves along the side walls. Smuts' turn came to speak. He stepped forward and waited for silence. There was no silence! Instead, there was an uproar.

We sat in the 20th row. For a long hour we never heard a word that was spoken by General Smuts. The miners sang, shouted, hooted, hissed, booed, in English and in Dutch. For an hour this uneven contest continued. Then General Smuts left the platform, his message undelivered.

Next morning the pro-Smuts Johannesburg newspaper said:

"There were 1,000 people present and at least an equal number outside. Appeal for a fair hearing for the Premier was unheeded. They kept up a continuous uproar. At one time it looked as if the platform would be rushed."

IN THE KIMBERLEY DIAMOND MINES

We visited Kimberley, the roaring mining camp of 30 years ago. To-day it is dull, drab, respectable. The diamonds are all controlled by one combine. There is no more excitement in present-day Kimberley than there is in a cheese village in Holland. After one has seen the open cavern in the earth where Rhodes found his first fortune, one has seen all there is of dramatic interest.

Those who are supposed to know say there are enough diamonds in the mines of Kimberley to make these jewels as common as glass beads if they were marketed, competitively or indiscriminately.

Obviously the output must be restricted; it is. Obviously prices must be maintained; they are.

These diamond mines in Kimberley are worked by blacks, who are held in corrals, virtually as prisoners. Once they leave the employ of the mines they may never return. All the measures one can imagine, and some one cannot imagine, are used to prevent these blacks from stealing the diamonds. They have a special treatment for those who attempt to swallow diamonds, and another treatment for those who succeed in swallowing them. They lose few diamonds.

ON THE LAST LAP: "GOOD-BYE AND GOOD HOPE"

The train that carried us to Cape Town left Kimberley at 3 a. m. and arrived at 8 a. m. on the second morning.

With the journey's end in sight, both of us were extremely impatient. Upcountry we grouched a little when luck failed us, but philosophically accepted what fate brought and tried to make the best of it. I know that I worried very

SOUTH AFRICA'S MONUMENT TO CECIL RHODES

The estate of "Groote Schuur" has many memorials, chief among which is the Doric temple and bronze figures of Physical Energy, the monument erected by the Union of South Africa to honor the man who conceived the Cape-to-Cairo route. Broad grounds surrounding the estate are a preserve for the zebra, buck, and other animals of the country.

little, except when the fever was excessively troublesome; then I had to consider whether or not I would arrive at all. Otherwise time did not seem important.

But here, on the home stretch, the minutes dragged. The train seemed unnecessarily slow.

We were at once comfortable and restless. We passed by dozens of Dutch farmhouses—white, square, squat. They suggested the Pennsylvania Dutch farmhouses of America; but this rocky, barren, treeless land is not at all like the rich and fruitful Pennsylvania valleys. The bleakness, the dreariness of South Africa amazed us after the gorgeous luxuriance of the land farther north.

We finished breakfast. Cape Town was but an hour away. We passed stations and saw the familiar figures of commuters waiting for the 8:10 train.

We rolled into the Cape Town station. We stepped out on to the platform. We ignored the baggage porters who were trying to attract our attention. We solemnly shook hands while the amazed commuters looked on.

"Cairo to Cape Town! Why not?"

Next morning at daybreak we sailed for England.

We planned to be on deck to see the ship leave its moorings, to watch Table Mountain fade from view. We kept the appointment.

So did one other couple.

A young fellow stood on the dock, while an attractive girl leaned over the ship's rail. They spoke in undertones. But as the ship moved slowly out into the stream, I distinctly heard the young man speak the Cape's farewell. He spoke the words in the form of a question:

"Good-bye and Good Hope?" he called to the girl.

She touched her finger tips to her lips, waved them to him, and answered, "Yes, *Good Hope!*"

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LOOKING DOWN ON EUROPE

The Thrills and Advantages of Sight-seeing by Airplane, as Demonstrated on a 6,500-mile Tour Over Commercial Aviation Routes

BY LIEUTENANT J. PARKER VAN ZANDT

U. S. Army Air Service

"NO, SAH!" said Jo, our dusky man of all trades, when I asked him if he had ever flown. "Terrah firmah fo' me! An' de mo' firmah, de less terrah!"

But Jo is behind the times. Five years ago he might have been expressing, in a manner after his own kind, the instinctive sentiments of a large number of our citizens. To-day his position is no longer tenable. Europe has proved it. The remarkable growth of air transportation services on the Continent during the last six years, carrying close to 200,000 passengers and thousands of tons of mail and merchandise between the principal European cities, leaves no reasonable doubt that aircraft, as safe, reliable transportation agents, are here—and here to stay.

It was my good fortune recently to make an investigation of this development for the War Department, and to travel as a passenger some 6,500 miles over Europe on English, French, Rumanian, Polish, German, and Dutch air lines.

I had my initial first-hand report on European airways during our last night out of New York, from the Channel pilot who had come aboard. "Mayor of Dover," the Captain called him, in deference to his position as councilman in the Channel town that lies on the route of the English and French planes flying daily between London and Paris.

A big, burly Scotsman, with a voice like a husky foghorn, he paced the bridge where I had been allowed to remain, and, between instructions to the yeoman at the wheel, told me of air transportation, while the winking silver line of lights of Brighton slipped behind us and the chalk cliffs of the Dover coast shone dimly in the moonlight (see pages 269 and 273).

"It was the mail plane for Paris," said the "Mayor," "that first interested me in aviation. It would go over my head like clockwork every morning, as I walked to the office; I used to listen for it, and it was so regular you could set your watch by it.

RADIO GUIDED PLANES ENVELOPED IN FOG

"What kind of weather it was didn't seem to make any difference; on clear days it might be just a speck in the sky, and then when the fog was on the cliffs, it would roar down the street just above the housetops and disappear in the mist over the harbor. There were times I couldn't see it at all, and only the muffled

Photograph by Lieutenant J. Parker Van Zandt

THE HANDLEY-PAGE PASSENGER TRANSPORT PLANE IN WHICH THE AUTHOR FLEW FROM LONDON TO PARIS

Mechanics are seen checking up the engine and propeller installation before the plane is scheduled to depart. The pilot's and flying mechanic's cockpit may be seen forward of the passenger compartment, in the nose of the plane.

roar of the engines somewhere overhead betrayed its passage.

"I got to wondering how they found their way up there, in such thick weather, and then one day I stumbled on the secret. You see, my boy is pretty keen on radio and we have a set at home for the city concerts. One day, while tuning in, we picked up a pilot somewhere in the air, talking to the flying field at London. That chap was getting reports on his position in the sky and about the weather along the route; thought he ought to be getting near the Channel, but couldn't see it. In two or three minutes Croydon was telling him where he was—over a small fishing village on the French coast.

"Well, sir, that made me a bit interested, I can tell you. I began to read some Air Ministry reports about aviation and they opened my eyes. I found there were regular air lines all over Europe that could take you most anywhere you wanted to go; you can hop into a plane to-morrow in London and fly right across Holland and Germany to Moscow, Russia, or up to Helsingfors, Finland; or you can slip over to Paris and on to Constantinople, or down across the strait to Algeria and Morocco.

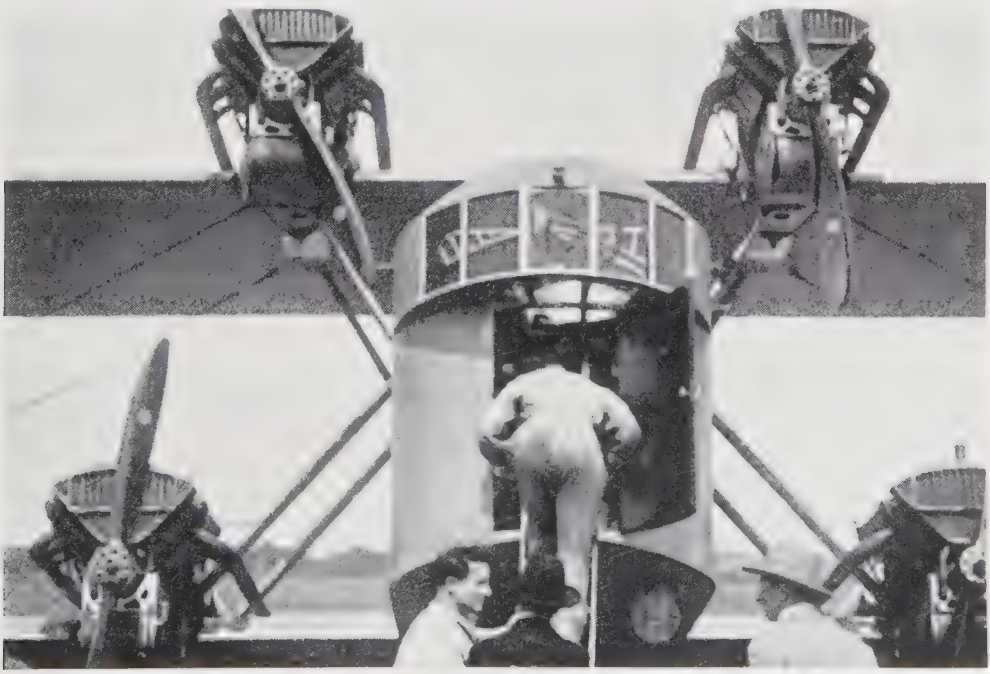
"England isn't so far behind the others, I guess; some 50,000 passengers have flown across the Channel since the Armistice, and most of them have traveled in British machines. Not one of these English fellows has ever landed in the water, but there was a Dutch plane a couple of years ago, with three passengers aboard, that came down in the Channel; landed on the Goodwin sands, and a Channel freighter took the pilot and passengers off and brought them over to Dover.

"So you are going to travel on all the air lines in Europe this summer? Well, I declare! I believe I envy you. Good luck—and safe landings."

An object for envy I felt, too, when a few days later I climbed into the British Imperial Airways bus at Trafalgar Square

A FOUR-ENGINE BLERIOT PLANE UNDER TEST FOR LONDON-PARIS SERVICE

Note the lights for night landing, mounted just beneath the floor of the fuselage.



Photographs by Lieutenant J. Parker Van Zandt

ANOTHER VIEW OF THE FOUR-MOTOR PLANE SHOWN ABOVE

Passengers and pilot may enter by the door in the nose of the fuselage or through a similar door in the side.

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DERBY DAY AT EPSOM

A few miles to the southwest of Croydon, the air station of London, is the most famous race course in the world, Epsom Downs, where the "Oaks" and the "Derby," established in 1779 and 1780, respectively, by the twelfth Earl of Derby, are run annually before hundreds of thousands of spectators.

bound for the flying field—and Paris. There were eight of us in the car, of whom five were Americans — in fact, Americans form the major part of the cross-Channel air traffic.

Two silent Chinese girls, in the latest European styles, sat wedged in one corner, while beside them a loquacious broad-brimmed Oklahoman held conversation with a stout, bejeweled lady from Texas.

Some sense of sharing an adventure in common seemed to penetrate for the time that air of stiffness so habitual between strangers thrown together by the hazard of travel. Certainly there was nothing to dissipate it in the ride out through the crowded London streets to the London Terminal Aërodrome at Croydon—bowling down winding lanes at 40 miles an hour.

AIR STATION PRESENTS THE ASPECTS OF A RAILWAY TERMINAL

To any timid passenger the sight that met us at the field would have been very reassuring. An imposing row of offices and waiting rooms of the Dutch, French, and British services, a courtyard before the Customs building well filled with limousines and busses, a bustling and

scurrying to and fro of tourists and attendants—the normal pulse and movement of a typical railway station.

The noon liner from Paris had just arrived, a French bimotored Goliath, and stood among a group of planes beyond a picket fence that separated us from the flying field. Its big propellers were still idly turning over, the last of its dozen passengers just emerging through a doorway in the fuselage.

OUR PILOT HAD BOMBED THE CAPITAL OF AFGHANISTAN

A pompous, uniformed guard stood beside a large traffic board on which the positions of the planes en route along the airways were represented by various colored tacks. To him I appealed to point out our pilot.

"There 'e is," said my informant, indicating a stocky youth in a worn leather coat, leaning against the wing of a Handley-Page. "Hi'm told 'e's frightfully hunpopular in Hafghanistan. You see, 'e was flying a bomber down there, and 'e dropped 'is load on the Hamur's 'arem."

It is one of the boasts of the Croydon field that its customs officers are as expeditious and efficient in their sphere as is the aircraft itself in its own element. I soon found myself comfortably installed in the seat of honor beside the pilot in the nose of the *Princess Mary*, the two Rolls-Royce engines close behind me on either side, under half-throttle, humming tranquilly their message of latent power.

A messenger came scurrying out, waving the final clearance papers for the pilot; a burst of blue smoke and a rising roar from the starboard motor, and the great plane began to circle slowly out from the line of hangars toward the green field.

An airplane on the ground is an unwieldy creature, and we bounced along over the uneven turf, as the pilot cautiously sought the far corner, from which we had a clear run of the length of the

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LOOKING DIRECTLY DOWN UPON THE TOWER BRIDGE, LONDON

It has been suggested that the Thames River might be used as a landing base for airplanes in the heart of London, to avoid the long bus trip out to the terminal field at Croydon. The presence, however, of the numerous bridges and innumerable small craft on the river and the prevalence of low fog and other unfavorable water conditions make this suggestion impracticable at the present time.

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ST. PAUL'S CATHEDRAL, LOOKING WEST DOWN LUDGATE HILL: LONDON

The beauty in proportion and perspective of many great public buildings is not truly appreciated until they have been seen from the air.

aërodrome for our take-off into the wind. A sudden, engulfing, devastating roar, as the throttles of both engines were fully advanced, control wheel well forward to raise the tail of the plane, and we began to roll swiftly ahead, gathering fresh momentum with each fleeting instant.

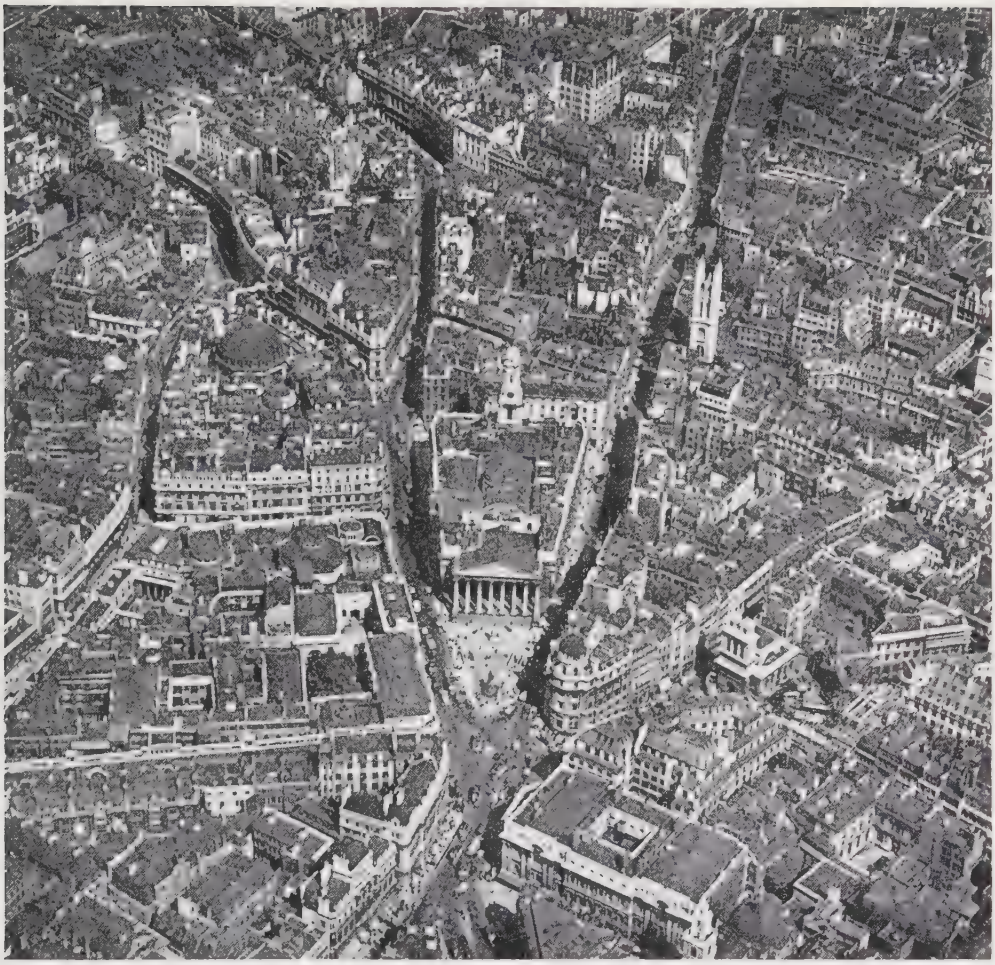
THE AIRPLANE IS A MAGIC CARPET BEARING ONE THROUGH THE SKIES

One is scarcely conscious of the actual moment of leaving the ground until the absence of further jolting and the slight billowing effect, as the wings cushion in the warm air, make one realize with a peculiar thrill that he is off at last on his great adventure. The near-by hangars, trees, and hedges flash by the wing tips in a blur; then the ground seems to be wafted gently downward and the whole sweep of the surrounding countryside comes into view as the pilot zooms to a higher altitude.

There is no sense of dizziness, no sudden feeling that the solid earth is deserting the feet; just a growing sense of release, a feeling of age-old restraints cast off, like a sigh of relief from the soul.

But the emotion of cross-country flight must be experienced to be appreciated. Like the taste of fresh olives, it defies description. There is a sense of exhilaration and freedom invoked by the spectacle of green hills and dales streaming rapidly away beneath, as one floats above with little realization of his own motion, save the knowledge that the checkered farm land just below in a brief space of time will be fading into an indistinct horizon far behind.

Some remote atavistic instinct is stirred at this sudden break with accustomed limitations, flooding one's soul with a new spirit of power and importance, as his magic carpet bears him swiftly through the sky.



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THE BUSINESS HEART OF LONDON AS IT LOOKS FROM THE AIR

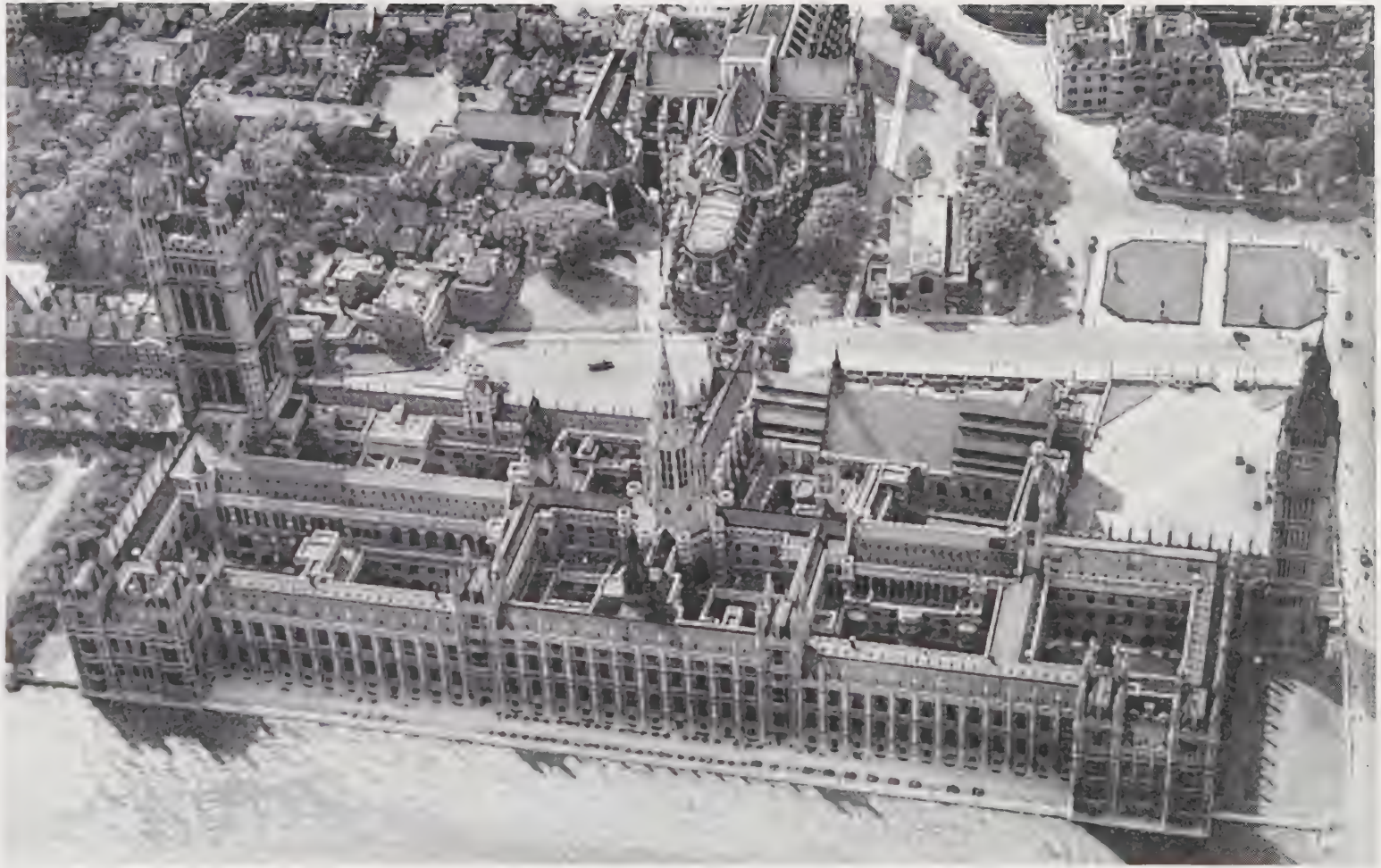
Note the absence of street cars and the great number of autobusses. In the center of the picture is the Royal Exchange (the building with the columns), and to the left is the jumble of roofs of the Bank of England, immediately beyond which is the Stock Exchange. At the bottom of the picture, in the center, is Mansion House, the residence of the Lord Mayor.

Flying a few hundred feet above a low-lying range of hills, we skimmed past several magnificent English manors, their well-kept grounds laid out with geometric precision.

The white ribbon of the road curved over the hilltop and down the valley, beckoning us to follow, while the ever-changing and widening vista of the English countryside held the attention enthralled. To be truly appreciated, England must be seen from above—"her sights and sounds, dreams happy as her day."

There was something warm and refreshing in this embracing vision of friendly cottages hidden in foliage, winding lanes bordered with hawthorn hedges, and the mile after mile of cultivated fields upon which the golden harvest now stood ripening, as we sped in an unveering line over hill and coppice.

It has been said that an English summer consists of two days of sunshine and a thunderstorm, but our weather could not have been more ideal. The air was clear and warm, as we neared the coast, and from an altitude of 1,500 feet we could trace the gray waters of the Channel far to the north toward the Hook of



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LOOKING DOWN ON THE HOUSES OF PARLIAMENT: LONDON

In the central background is Westminster Abbey. In Parliament Square to the right, are statues of Sir Robert Peel, Lord Palmerston, the fourteenth Earl of Derby (1799-1869), Disraeli, and Canning.

Photograph by Aërofilms, Ltd.

THE SEA FRONT AT BRIGHTON, THE WATERING PLACE ON THE ENGLISH CHANNEL SO FREQUENTLY COMPARED WITH AMERICA'S ATLANTIC CITY

Note the row of white "bathing machines" on wheels. In the middle distance, at the right, is the Palace Pier.

Photograph from Lieutenant J. Parker Van Zandt

A FOUR-PASSENGER COMMERCIAL PLANE USED ON SOME OF THE AIR LINES BY AN ENGLISH AIRWAYS COMPANY, IN FLIGHT OVER SUSSEX

This plane may be hired to fly "anywhere any time," at a standard gross price of two shillings a mile. This includes the pilot's salary and all other expenses connected with the operation of the plane itself. Last summer an American business man hired such an air taxi and traveled some 12,000 miles over Mediterranean countries.

Holland, and south to where the water and the distant haze converged on an unreal horizon.

A TWO-HOUR BOAT TRIP CUT TO 22 MINUTES BY AIRPLANE

The rays from the afternoon sun threw a shadow of the plane on the earth below—a grotesque, miniature shadow that slipped silently over hedge and plowman and cottage, streaked across a field of yellow grain at the Channel's edge, slid precipitously down the chalky cliff, and without an instant's pause plunged out across the water.

A score or more of vessels were in sight, one big chap, outbound for some far-off port, lying directly on our path, black smoke streaming from the stacks, its murky track visible for miles in its wake. Our fleeting, streamered shadow eclipsed for an instant the tiny-appearing passengers crowding the hurricane deck, plunged a minute later over an old schooner making lazily for Zeebrugge, and darted on over the gray Channel waters toward the low-lying coast of France, which now showed on the horizon.

We were 22 minutes from Folkestone to Boulogne-sur-Mer, 22 glorious minutes against two difficult hours by Channel boat. The clean, white sand of Le Touquet beach (Paris-Plage) lay beneath us, as we swung inland.

Seemingly far ahead against the horizon hung an ominous bank of cumulus clouds, their flat tops in brilliant sunshine, while below the soft outlines of the open fields were submerged in shadow.

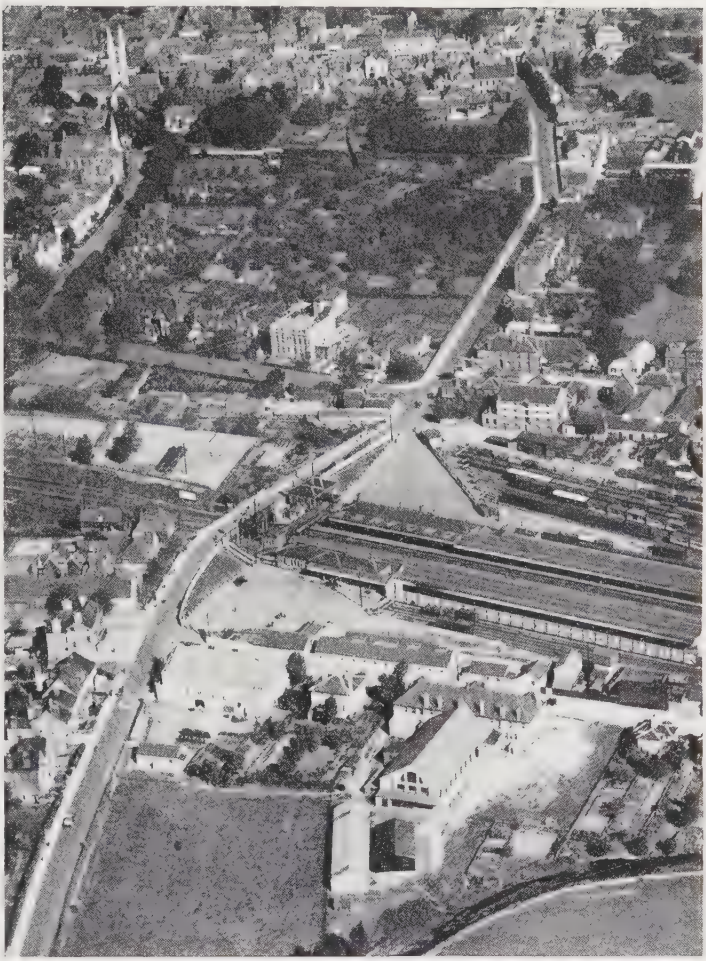
THE PILOT GETS WEATHER REPORT BY RADIO PHONE DURING FLIGHT

An aviator's life is said to consist of hours of idleness punctuated by moments of intense fear, but the pilot seated by my side would have quickly put to rout such a slander. At the moment, he was

talking into his radio phone, the mouthpiece of which was attached to a jointed metal sleeve strapped to his chest. I could see his lips moving, but no sound of words reached me above the enveloping roar of the engines mounted so closely on either side.

He switched the phone to receiving and in a minute leaned over, grinning, to shout in my ear that Le Bourget reported the sky clear as far as Beauvais, and that he would fly above the clouds the intervening distance.

Wisps of cloud were already drifting by, filmy gossamer outposts of the massed battalions ahead. Very different and harmless they appeared when seen close by, tossed by the slip-stream from our propellers, but rather frightening where the cross-wind currents crowded them into great pressure ridges towering hundreds of feet above our line of flight, or left dark, foreboding crevasses in the cloud floor.



Photograph by Aërofilms, Ltd.

ASHFORD, ENGLAND, ON THE LONDON-PARIS ROUTE, IDENTIFIES ITSELF FOR THE AIRMAN

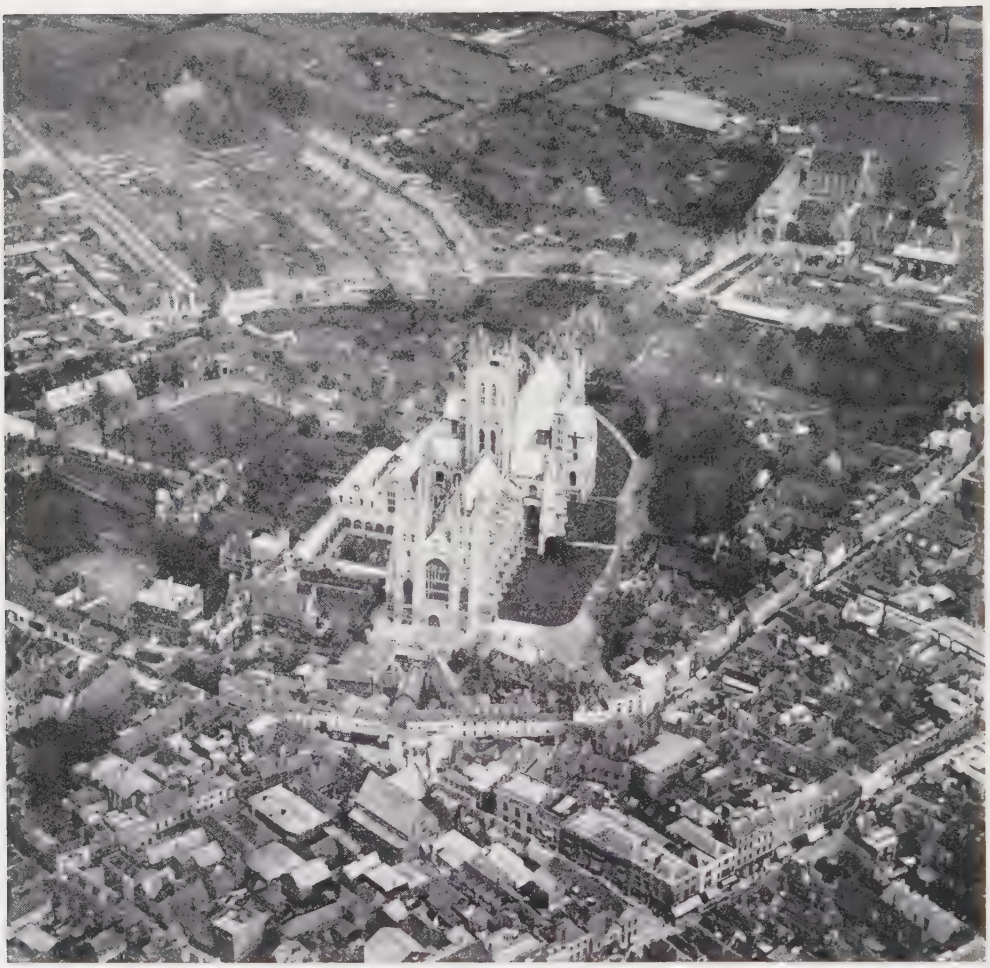
Note the sign on the roof of the railway station. There are now a number of cities in Europe and also in America which have painted markers on roof tops and prominent buildings to help the flyer identify his position. The Army Air Service in America has been active in promoting this service along the model airways which the War Department is establishing.

PLANE'S SHADOW SCAMPERS OVER CLOUD BANKS

With a sudden rush, the green fields far below were blotted out of sight, and a damp, gray mist enveloped us, a sense of floating in some dimly lit, enormous ocean cavern—then abruptly into brilliant sunshine again, while just beneath our wings, looking for all the world like a fresh-fallen field of snow, stretched the great mesa land of clouds.

Among the many wonders of flight, there is a special and peculiar enjoyment evoked by flying in clouds—a feeling both of arrogance and humbleness in thus prying into the infinite wonders of Nature's overhead workshop, a quickening of the sense of "the incommunicable and elusive excellence that haunts all beautiful things."

Our shadow, now faintly fringed with rainbow colors against the brilliant white surface just below, and prodigiously increased in size, scampered over the tum-



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CANTERBURY CATHEDRAL VIEWED FROM ABOVE

bled cloud layers with amazing speed, its nearness emphasizing the swiftness of our flight.

Through an unexpected rift in the woolpack, a patch of dark fields appeared beneath our wing and the word "Abbeville" became discernible, written in big white letters on the ground. This is one of the intermediate stations along the airway where supplies and shelter for the airmen are available. My companion reported our passage by radio and received from Abbeville a reply that we were invisible from the field.

The wind-scattered edges of the cloud bank faded behind us as the Cathedral of Beauvais came into view, casting long shadows in the fading light. Then Paris under a twilight glow, a tangle of red mansard roofs in the distance, with the Eiffel Tower and Sacré Cœur standing sentinel against the crimson sky. Le Bourget was at our feet. The pilot reeled in his wireless antenna and, with engines throttled, we came wheeling into the wind over the Customs building, the ground rushed up to meet us and skimmed by under our wheels, the tailskid settled easily onto the grassy turf and—*nous y sommes.*

"Have you anything to declare, *des cigarettes, du tabac?*" asked a bored-looking customs officer. *"Non? Eh bien, passez."*

And we are off for the Place de la Concorde in a big motor bus, tongues loosened as everyone exchanges impressions with his neighbor.

© Central Aërophoto Co.

THE CHALK CLIFFS AT BEACHY HEAD, BETWEEN BRIGHTON AND DOVER, SEEN FROM THE AIR

It is a remarkable fact that, with the thousands of airplane flights between London and the Continent, there are only two instances of planes being lost in the Channel. In one of these cases it is believed that the pilot was shot by an insane passenger, and regulations were thenceforth issued prohibiting passengers from riding in the cockpit with the pilot.

It is hard not to look down with a touch of conscious superiority on the jostling street throngs, tired workmen, who have trodden the dusty road of common tasks, hurrying home, while for us all the heavens have sung of liberty.

OFF TO TOULOUSE FOR A FLIGHT TO MOROCCO

Not many evenings later I boarded a night train at the Quai d'Orsay bound for southern France. The lights of the French capital were still glowing in the sky as I tumbled promptly into bed preparatory for an early rise in the morning.

It was shortly after 4 a. m. when the voluble conductor awakened me — the same whose palm I had crossed the previous evening to insure against any midnight intruders attempting to share my compartment. "For ways that are dark and devious," the French *wagon-lit* conductor has few superiors.

We were late rolling into Toulouse, the northern terminus of the French air line to Morocco, and although it was scarcely light, the local field manager was at the Gare du Midi awaiting us.

A few minutes at the Poste to collect the score or more of heavy mail sacks that had come down on the same train, and we were rattling over the cobblestones in the ubiquitous Ford toward the open fields.

The air port at Toulouse is the main repair and construction field for the entire Latécoère system, but there was no time this morning for even a hasty inspection.

A Breguet biplane was on the cement mat before the long row of hangars, its Renault engine idling. Upon our appearance a small group of mechanics precipitated themselves upon the mail, stowing the sacks in two large streamlined containers hung on either side of the landing wheels, beneath the lower wing.

A sleepy-looking *paysan* in a Customs

Photograph by Lieutenant J. Parker Van Zandt

PASSENGERS ARRIVING FROM LONDON AT THE PARIS TERMINAL AËRODROME, LE BOURGET

Most of these passengers are American tourists. This plane has seats for 12 passengers, with a luggage compartment in the rear, from which the mechanics may be seen unloading baggage and air express. The engines are 350-horsepower Rolls-Royce motors, such as were used in long-distance bombing planes during the war. On the upper wing may be seen the gasoline tanks, from which the fuel reaches the engines by gravity.

uniform made some hasty notes relating to my passport and declared impecuniosity, and I scrambled into the rear open cockpit as the pilot began to taxi slowly away from the buildings.

BEGINNING THE MOST MEMORABLE AIR RIDE IN EUROPE

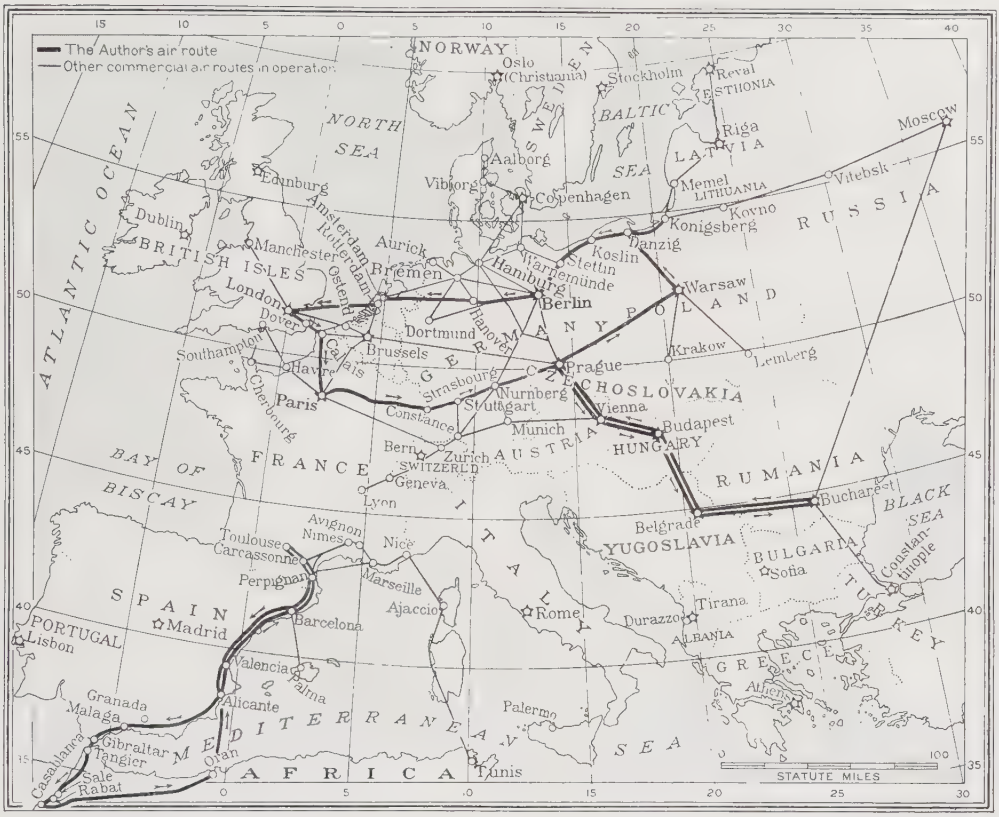
An answering roar from the engine as the throttle was advanced, wheels plowing through the deep dewladen grass, tail poised for flight—and I was off on what was destined to prove my most memorable air ride in Europe.

A wide turn over Toulouse, the street lights glowing dully through the ground mist. In the half-light of early morning the earth appeared dark and cold, and the crisp, clean rush of air past my uncovered cockpit made me thankful for the warm flying suit borrowed from a friendly mechanic at the field.

The gentle valley of the Garonne lay sleeping under a fleecy sheet of light fog, the apparent complete suspension of life evoking in some peculiar way a sense of special virtue in our own animation.

Like a child's ribbon, the canal lay curled at the base of the furrowed hills, a solemn double row of poplars guarding its banks. The black thread of the railroad now ran close beside it, now struck out boldly across the rich farm land toward where the valley narrowed before the encroaching Pyrénées.

A grayish mist across the narrow corridor warned us to descend to a lower altitude. The whistle of the flying wires rose to a shrill pitch, as we gathered momentum in the downward glide. Wisps of damp cloud flung by, and then a sudden opaqueness, as we plunged with noiseless impact into the threatening cloud front ahead.



Drawn by A. H. Bumstead

THE ROUTE FOLLOWED BY THE AUTHOR IN HIS 6,500-MILE AIRPLANE TOUR OF EUROPE

The cost of travel by air in Europe at present is not excessive and is roughly equivalent to first-class passenger travel by rail. The actual cost of air tickets for the total 6,500 miles was $380, or between five and six cents per air mile. It is to be remembered that the actual ground distance is in almost every instance considerably longer than the air distance involved. For the flight from Toulouse, France, to Spanish Morocco and return, the distance of 2,360 air miles is flown at a cost of $84, or at a rate of three and one-half cents per air mile. If the cost of sleeping accommodations and meals on trains or boats is included, the travel by air in many instances is actually more economical than first-class passage by any other means. The total flying time was 73 hours for the 6,500 miles, or an average speed of 89 miles. The two principal reasons for the low cost of this air tour were the generally favorable rate of exchange now prevailing and the government subsidies granted to the air lines, which cover a portion of the expense of operation.

In the damp semidarkness before me the glimmer of the radium-painted altitude indicator marked our steady descent from 300 meters to 200, 100—and then we were in the open again, with the dreaming farmhouses just beneath and the tall poplars reaching midway up to us.

Ahead looked unpromising. The crests of the hills crowding in on both sides were hidden in cloud, and the red-tiled roofs and yellow haystacks loomed up uncomfortably near, as we cautiously pursued the contour of the valley bed, marked by the canal.

Pang! A drop of rain strikes my forehead and smarts like a hailstone. The damp, chill air penetrates through the flying suit and the lowering cloud just overhead shuts out the morning light.

A half hour passes. We dodge through a winding pass ahead, swing to the east again, and abruptly there opens before us a glorious picture of the breaking day. Still in shadowland, as from the mouth of a giant cavern, we gaze out under the

Photograph by U. S. Army Air Service

THE FAMOUS ARC DE TRIOMPHE: PARIS

France's Unknown Soldier rests beneath this arch. Captured German guns may be seen surrounding it. Shortly after the World War, a French flying ace flew a pursuit plane through this archway at a speed of 140 miles an hour. The clearance between his wing tips and the sides of the arch was less than six feet on either side. The slightest error of judgment would have meant utter disaster.

Photograph by Compagnie Aérienne Française

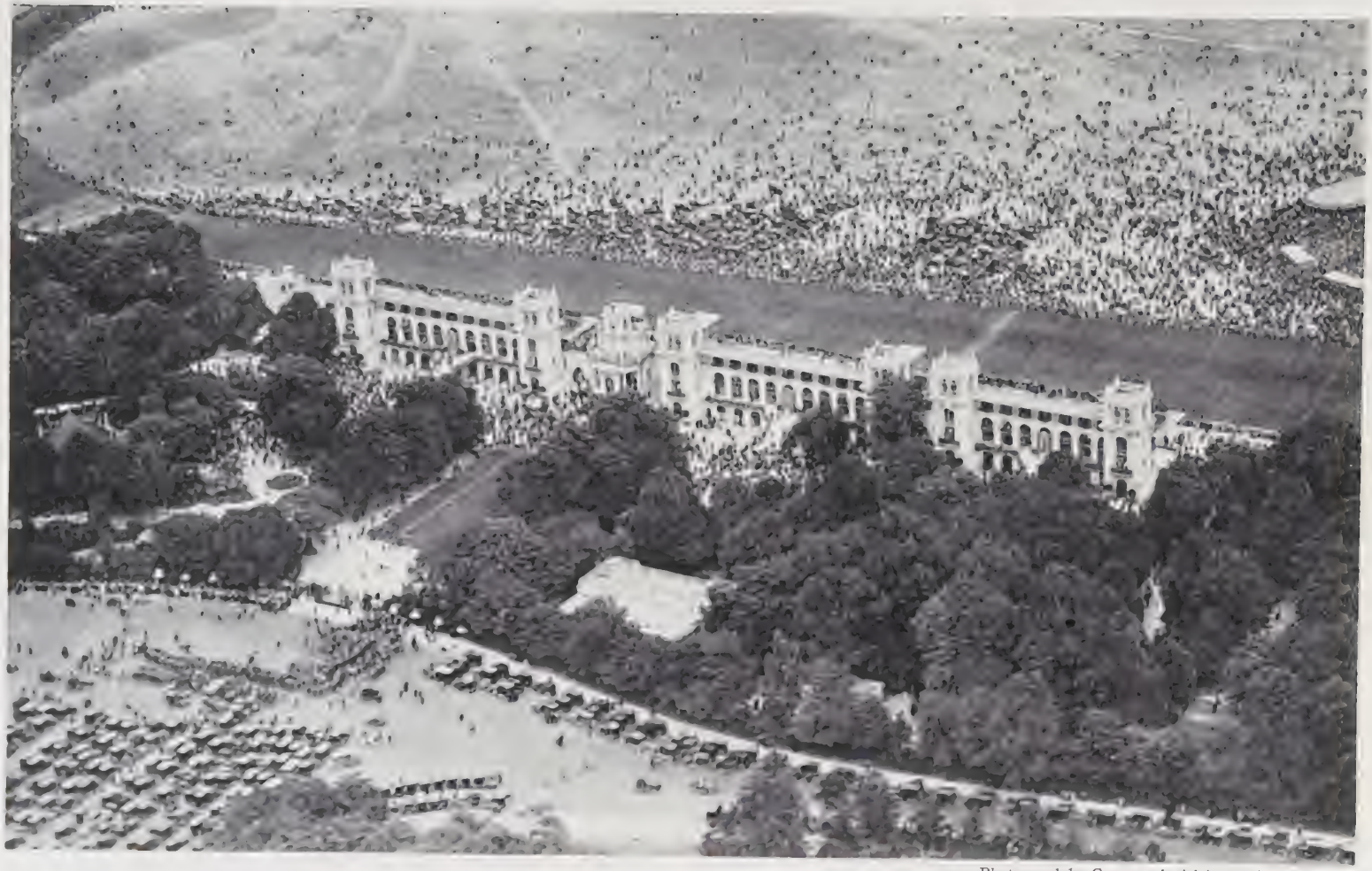
THE OUTSTRETCHED WINGS OF THE TROCADÉRO SEEN FROM THE AIR: PARIS

The central portion of this great museum building contains a festal hall having a seating capacity of 6,000. The two minarets, rising to a height of 230 feet, are conspicuous features of the Paris landscape. On the opposite bank of the Seine rises the Eiffel Tower.

Photograph by U. S. Army Air Service

THE JULY COLUMN, IN THE PLACE BASTILLE: PARIS

Rising on the site of the fourteenth-century castle which in time became the notorious prison and emblem of tyranny known as "the Bastille," this column of bronze commemorates not the destruction of the fortress at the beginning of the French Revolution, on July 14, 1789, but the heroes who fell in the revolution of July, 1830. In the right foreground is the St. Martin Canal, which beyond this point is vaulted over for a distance of a mile and a quarter and runs beneath the Boulevard Richard Lenoir.



Photograph by Compagnie Aérienne Française

AN AIRPLANE VIEW OF THE LONGCHAMP RACE TRACK, IN THE BOIS DE BOULOGNE, ON THE DAY OF THE GRAND PRIX

The first race of the season held at Longchamp early in April, is a fashionable fixture, when the new spring fashions of the Paris modistes are seen in all their glory. The Grand Prix, chief of the French races, is run on the last Sunday of June, inaugurating the summer season.

Photograph by Flandrin

TOULOUSE, ONE OF THE IMPORTANT CITIES OF SOUTHERN FRANCE, FROM WHICH THE FLIGHT TO MOROCCO BEGAN

The terminal flying field may be seen in the central background of the picture, marked by a prominent row of hangars along the railroad track. A number of Americans have studied at the University of Toulouse, and after the war special courses were given to Army officers. Note the picturesque bridges across the Garonne.

black wedge of the storm lifted above us into the golden, sunlit country beyond.

Through some momentary, drifting cloud the low-lying sun sends forth long bars of alternate light and shade, like giant chariot spokes, as if to guide us in our eastward flight; and the whole countryside lies floating under a rising mist that covers the land with a transparent lavender veil. Such a glorious moment's careless rapture is worth "an age without a name."

ACROSS SPAIN ON A SACK OF MAIL

The walled city of Carcassonne slips by, sharply etched in light and shadow (see page 282), and the glistening waters of the Mediterranean appear ahead. As we swing by the eastern slopes of the Pyrénées, the clouds that had seemed so black and ominous overhead now appear snow-white, soft, vaporous, streaming south.

Perpignan lies in a fertile valley at the eastern foot of the Pyrénées, and here we make our first landing, one hour from Toulouse, to pick up the mail from Marseille. The connecting plane has arrived before us with another passenger, a young Frenchman with military clothing samples for his clients among the *fonctionnaires* at Rabat.

My comfortable chair is removed and replaced by a huge sack of mail; *"neuf kilos excédent"* of baggage is wedged in alongside; Monsieur, my new traveling companion, takes his place before me, while I mount solemnly on top of the mail sack, head and shoulders exposed to the wind. From such a vantage point, *en plein air,* I tour the length of the Spanish coast!

It is noon and we are approaching Alicante, 6,000 feet above a tangle of rocky slopes bordering the sea. Sun-baked white huts cling precariously to the ridges. Terraces, burnt dry, struggle up the hillsides. On our right the mountains rise sharply pointed, precipitous, gullies and pockets in their bare sides, patches of rough cultivation on their lower slopes. Dried river beds lie parched in the heat of the summer sun.

On our left the great bowl of the Mediterranean, green to deep indigo-blue along the rocky shore line, silver-gray on the shimmering horizon; a few toy fishing boats motionless on its placid surface.

The drowsy, friendly, comfortable purr of the engine which reaches us muffled by the cotton in our ears, and the deep drafts of cool fresh air have induced my companion to doze in the corner of the cockpit, his feet drawn up under him on top of packages of machine parts, the scarf about his neck waving languidly, like an ancient altar flame, in the eddies of wind above his bent head.

Barcelona, with its beautiful park, its monumental bull ring, its uncompleted Cathedral, is three hours behind us. Peñiscola, that extraordinary cluster of gray walls and white fishermen's huts clinging to a tiny rock thrown out like a button into the sea (see page 286), has faded into the distant haze. This is Spain, dry, sunburnt Spain, whose brown hills and relentless heat have burned themselves so indelibly into Spanish character. Valencia and its fertile valley lie forgotten to the rear (see page 289).

WE TRANSFER MAIL TO A PLANE BOUND FOR ALGERIA

Alicante at our feet, choking under a dense blanket of dust stirred up by the unbidden sirocco. The sirocco is as unwelcome in Spain as is the mistral in southern France.

We leave our cool height and glide down slowly, skim over a fence of rough piled stones, and settle to the earth, kicking up a great cloud of yellow dust behind us, as we taxi to the hangar. What a contrast with the cool green field at Toulouse a few hours earlier! Here the barren, sandy ground seems to seethe in heat and the air is thick with suspended dust.

No time for lunch. A cup of black Spanish coffee while the mail is being transferred to a waiting plane, a few pesetas to the sandaled, slatternly *femme de buvette,* and we are off, happy to rise quickly above the mantle of dust and breathe the clean air again. The hot wind off the bare hills clutches at the plane and tosses it angrily about, until we pass suddenly into the cool stratum above and make smoothly for the distant peaks of the Sierra Nevada (see page 292), far to the south.

Photograph by Flandrin

"THE WALLED CITY OF CARCASSONNE SLIPS BY, SHARPLY ETCHED IN LIGHT AND SHADOW" (SEE TEXT, PAGE 281)

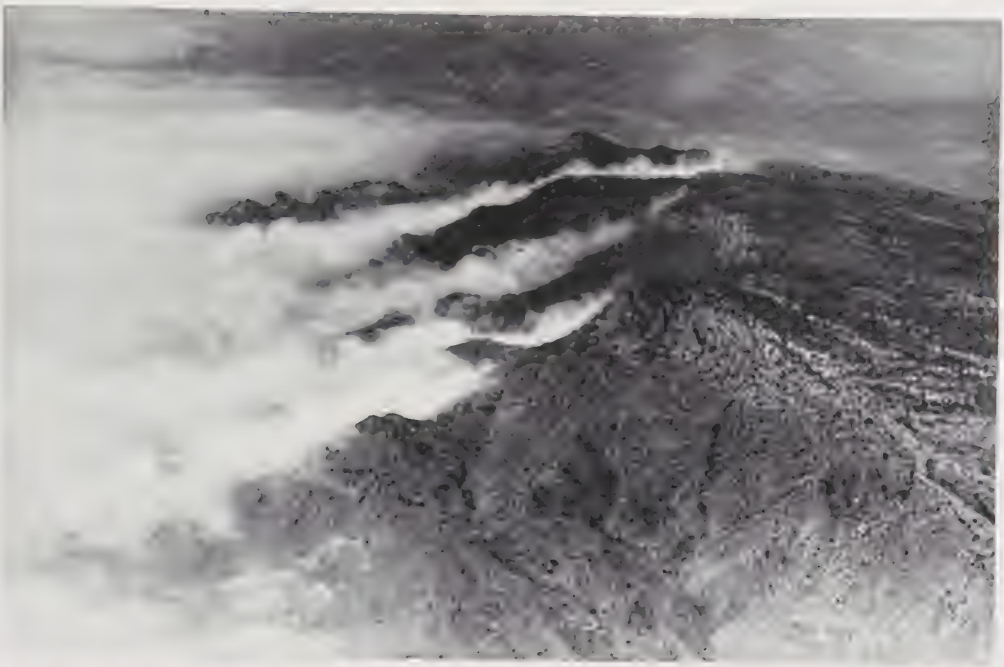
In 1849-79 the fortifications of the citadel were restored by the famous architect Viollet-le-Duc, who considered them the most perfect and picturesque examples in Europe of defensive works of the 11th-13th centuries.

Monsieur nudges me to note the sun-stricken fort and tiny harbor of Alicante, with the breakwater thrust out into the sea. As we watch, a seaplane takes off, bearing the mail for Algeria which we have brought from France. The following week, if all goes well, I will be returning from Oran, 200 miles across the blue Mediterranean, on that same hydroplane (see page 303).

From somewhere among the packages under his feet, my companion produces a shoe-box, which he opens to reveal a *"déjeuner français, vin compris!"*

Here is good fortune, indeed; and 3,000 feet in the air we drink each other's health with red wine from a leaky folding cup, while the orange groves of Murcia slip away beneath and the sullen Sierra range unfolds in seemingly endless panorama ahead.

A snow-clad peak appears, dimly visible above its companions upon the horizon; two hours, and it has passed beneath us and lies indistinguishable among its neighbors, now far to the rear. Thus does air travel obliterate ancient barriers. Tiny white villages, like clustering flights of egrets, begin to dot the great brown slope rising up from the shore.



A STORM BREAKING OVER THE PYRÉNÉES NEAR PERPIGNAN (SEE PAGES 275 AND 281)

Photographs by Frandrin

AN AIRPLANE VIEW OF GERONA, SPAIN, BETWEEN PERPIGNAN AND BARCELONA

The conspicuous building in the middle distance, with only one of its octagonal towers completed, is the city's Gothic cathedral, begun in 1312. Gerona boasts of one of the most heroic defenses of history, when, in 1809, a small Spanish garrison, aided by a handful of English volunteers, withstood a French army of 35,000 for seven months. The French lost 15,000 men before the fortifications whose ruins still crown the encircling heights.

Photograph by Flandrin

AN AIR VIEW OF BARCELONA, SECOND CITY OF SPAIN

This great seaport seems more closely related in spirit to the French port of Marseille than to the Spanish cities in the south. There are many beautiful residences on the foothills surrounding the city.

THE CITY AND HARBOR OF TARRAGONA, SPAIN

The bull ring (near the middle of the picture) is a conspicuous landmark of almost every Spanish city of importance. It is in Tarragona that the celebrated liqueur of the Grande Chartreuse has been manufactured since 1904, when the monks of Grenoble were forced to leave France.

Photograph by Flandrin

"THE GIBRALTAR OF VALENCIA"

One of the most remarkable natural curiosities along the eastern Spanish coast is Peñíscola, a little fishing village on a rock out in the Mediterranean several hundred yards from the coast and joined to it only by a low, narrow sandy strip. It is the more extraordinary because in this region the shore line is quite straight and regular and the hills have receded to some distance from the sea. This stronghold was wrested from the Moors by Jaime I of Aragón in 1233. It was the residence of Benedict XIII, antipope, with his cardinals, after the Council of Constance deposed him, in 1417.

A group of fishermen's huts appears at the foot of the cliffs, where a welcome beach affords a possible *terrain de secours,* should our faithful motor fail us. The tiny white ribbon of a road creeps along the face of a rocky cliff, hot and panting under the flooding sunlight, until it finds brief respite in a shadowy tunnel.

ALHAMBRA PALACE A HALF HOUR'S FLIGHT TO THE RIGHT

Our new pilot, who joined us at Alicante, is a tall, vigorous-appearing Corsican with leathery skin, tremendous hooked nose, and dark, flashing eyes. He points to the jumbled hills thousands of feet below, pulls his nose, makes a wry face, and shakes his finger disparagingly. The tanned kerchief about his neck whips in the breeze; the silken sock which he wears for a helmet is much the worse for constant exposure to grease and oil; and his sharp eyes face the wind without the protection of goggles.

A valley opens out and Málaga appears, a welcome sight after four hours.* It is hot on the ground, and tropical palms, their fronds gray with dust, border the field. Up this valley a brief, cool half hour by air—and most of a disagreeable day by Spanish train—lies Alhambra Palace on its wooded hill, Granada at its feet (see page 294); and sometimes, when the wind is right, the pilot lays his course that way, deserting the shore line for the inland route.

But such was not our good fortune. In 10 minutes we have transferred to a new plane, and with another pilot are off down the coast, the lower contours flattening out as we rise above them.

Here at last the long Spanish coast ends at the Strait of Gibraltar, culminating in that strange, formidable outthrust of the earth named after a long-dead Moor

*See also "From Granada to Gibraltar—a Tour of Southern Spain," by Harry A. McBride, in THE GEOGRAPHIC for August, 1924.

(Tarik). The wind sweeps through the narrow strait, scattering sudden flashes of white foam in the Mediterranean blue, like fireflies against a twilight sky, while beyond lies Ceuta on the Moorish coast, with the highest peak of its headland, the African "Pillar of Hercules," standing out menacing, portentous (see page 298).

SKIRTING THE AFRICAN COAST UNDER A PITILESS SUN

The international port of Tangier beneath our wings, white, flat-roofed houses rising above each other in tiers of cubes, a solitary minaret jutting into the air, a gray line marking the trace of ancient battlements, Portuguese or English.

To our left lie the Riff hills, where Spain is vainly bleeding herself to death; before us, brown, burnt, and dead, the wide, rolling world of the Bled, the Moroccan veldt; on our right, the restless blue of the Atlantic. This is the East, bright and shining as a sword, under a pitiless sun.

Here and there, on the lone, treeless plain, are flocks of Berber sheep, conical huts of the *indigènes,* and the clustered black tents of nomads. We skirt the African coast, where Phœnician, and, later, Portuguese caravels crept cautiously southward.

The heat at this hour of the day, even at 2,000 feet, is stifling. From my exposed perch on the sack of mail, the blast from the propeller is like that from the opened grate of a furnace; impossible to look westward, toward the burnished sun low on the horizon.

I crouch down to find shelter in the shadow of the cockpit, but the oppressive air seeps up and stifles with its stagnant warmth.

Our pilot descends to a few hundred feet above the Bled, where it is surprisingly cooler. The white-dovelike glitter of an Arab town appears by the blue rim of the Atlantic, the plunging breakers crashing soundlessly at its feet. Forlorn processions of camels move along the dusty trails; an astonished Moor, wrapped in loose, voluminous robes, looks up from his ambling mule.

Then Salé (Salli) of a dazzling whiteness, ancient home of the "Sally Rovers," and Rabat-el-Fath, the Imperial City, on the banks of the Bu Regreg, winding down to meet the blue of the ocean under high cliffs, through a brown-velvet valley (see illustration, page 300).

As we glide down over the Residency, the sun slips at last behind the low, banked clouds on the horizon, in gray mist and secret splashes of fire, and the red cliffs across "The Father of Glittering" are reflected like a flame in the river.

Here Monsieur, my traveling companion, bids me bon voyage and crawls stiffly over the side of the fuselage; my sack of mail yields its place to a comfortable chair, and the pilot and I are off in the closing hour of the day for our final hop.

THREE CIVILIZATIONS PASSED IN REVIEW IN 15 HOURS

The blinding light of the afternoon has given way to a velvet softness. The rolling Bled upon the Atlantic still lies burnt and brown, but there is more water here in the occasional meandering stream than in the sun-baked arroyos of Spain.

Roused by the roar of our engine, great storks rise leisurely before us and wing their way across a marsh, a study in black and white. At a bare 100 feet of altitude, we skim over a low stone wall, behind which an imperturbable, worm-eaten camel stalks languidly round and round a water wheel. Here are the squalor and simplicity of primitive life in a land burnt dry by an African sun.

Little native donkeys appear almost invisible under their heavy loads; an ass and a camel march slowly along together; in the distant eastern haze are the foothills of the High Atlas Mountains, forbidding refuge of the dissident Berber tribes, the *insoumis.*

The pilot dips down suddenly to a few feet above the broad Atlantic beach, and, with wheels almost touching the sand, we skim south, dunes flying by our wing tip, the pungent salt air of the crashing waves filling our nostrils. Thus we rush suddenly upon Casablanca, zooming up over the artificial harbor, across the white and yellow houses and ocher-tinted towers, and come at length to rest upon the flying field beside a military camp (see pages 301 and 302).

In the cool of the evening I wander through the narrow, winding streets within the walls of the old Moorish

Photograph by Flandrin

VILLAREAL AND ITS ELBOW-TOUCHING SISTER TOWN OF ALMAZORA (IN THE BACKGROUND)

Oranges are one of the products for which Spain is noted and these two towns, between Tarragona and Valencia, are in the center of one of the most productive orange-growing valleys in eastern Spain.

Photograph by Flandrin

A BIRD'S-EYE VIEW OF VALENCIA, LYING IN A FERTILE VALLEY TWO AND A HALF MILES FROM THE MEDITERRANEAN

"You would take it for a piece of heaven upon earth," is the phrase used by the ancients to describe this picturesque and thriving city, which ranks next to Madrid and Barcelona among Spanish municipalities. Valencia was the scene of that favorite episode of Spanish ballad makers, when the Cid, "after his death," led his army against the Moors and achieved an overwhelming victory. The story is told in the eleventh book of Southey's "Chronicle of the Cid."

Photograph by Flandrin

THE HARBOR OF ALICANTE: SPAIN

The landing field is on the level plateau behind the city, while the seaplanes plying between this port and Oran, on the coast of Algeria (French territory), anchor in and take off from the harbor. The Spanish Government has not taken a sympathetic attitude toward the development of the French air line across its territory to Africa, and at present neither mail nor goods are permitted to be delivered in or taken out of Spain by air. The company, in fact, cannot ship by air spare parts which it may urgently require and for which it may have room upon its plane, but must send them to its intermediate fields in Spain by the usual slow methods of rail transportation.

THE HARBOR OF MÁLAGA, AT THE FOOT OF THE SIERRA NEVADA

Photograph by Flandrin

To the northeast, a distance of a cool half hour by air and a disagreeable day by Spanish train, lies Alhambra Palace on its wooded hill (see page 294). Sometimes, when the wind is right, the airplane pilot lays his course that way, deserting the shore line for the inland route.

Photograph by Flandrin

THE CORRUGATED FOOTHILLS OF THE SIERRA NEVADA ALONG THE SOUTHEAST COAST OF SPAIN

These hills are very rough and uninviting in many places and offer few opportunities for a safe landing, in case the motor of the airplane should fail. The pilots generally follow the shore closely, depending on occasional open beaches to afford a welcome emergency field when occasion requires.

quarter, the courteous *chef de l'Aérodrome* as my guide. Veiled women slip noiselessly past, an indolent Moor in scrupulously white garments goes by astride his donkey, a half-naked water-carrier staggers under the swelling goat-skin flask across his loins.

Here is the age-old, immemorial life of the East, a page out of the thousand and second tale of Scheherazade. Yet this very morning, a brief 15 hours before, I was 1,200 miles to the north, across the length of Spain, engulfed in the tumult of a European city. By the hazard of travel, the contrasts of a score of centuries have been compressed into those 15 hours; three civilizations passed in review, made luminous and dramatized from the strategic crow's nest of flight.

FROM PRAGUE TO BUCHAREST IN A DAY

There were eight of us who sat in the crowded bus of the "Compagnie Franco-Roumaine de Navigation Aérienne" on an early August morning, as it pulled up the long hill out of Prague to the military aërodrome on the plain commanding the Vltava (Moldau) Valley. Of my traveling companions one was a Frenchman en route, as I, from Paris to Bucharest; the rest were Americans destined for Vienna—a group of college students and a young man from Boston traveling with his mother.

Two days before I had come from Paris in a Spad plane with a Czecho-slovakian for company, and several hundred pounds of silks and perfumes bound for the Balkan capitals. For four hours on that trip we had flown across German territory, where a forced landing would have resulted in the confiscation of the plane and goods and the pilot doubtless thrown into jail.

France and Germany are still very much at cross-purposes regarding aviation. Germany, smarting at the extension of the Versailles Treaty clauses

Photograph by Flandrin

A THIN WHITE LINE OF HIGHWAY THREADING THE SUN-SCORCHED HEIGHTS OF SPAIN (SEE PAGE 286)

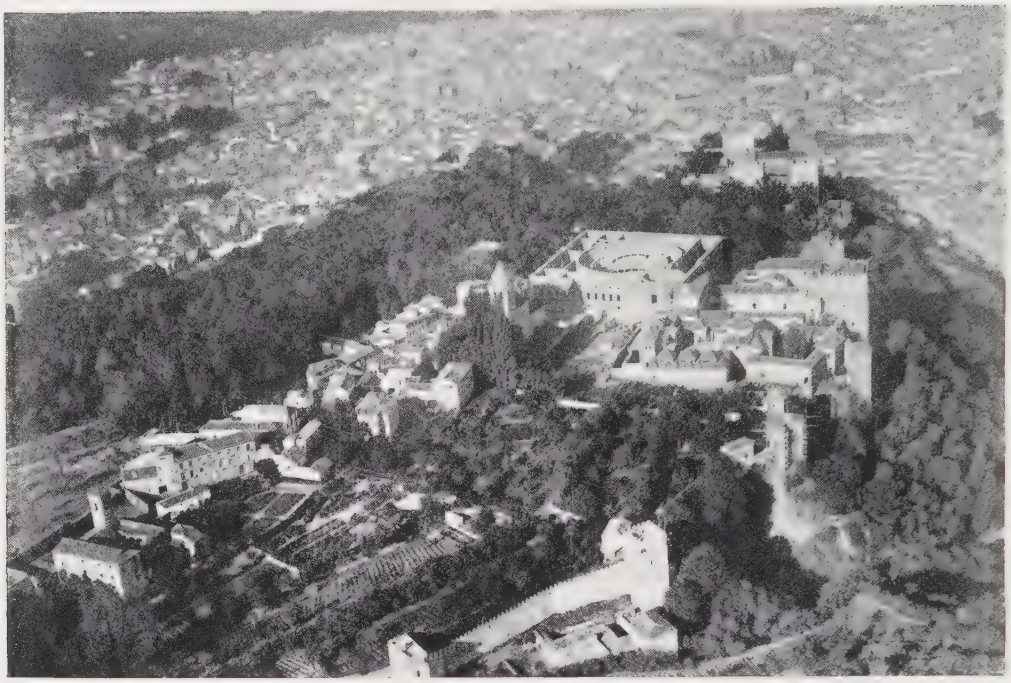
Where the mountains approach the Mediterranean shore the highway with difficulty cuts a tortuous path through the forbidding rocks. The generally arid and rugged character of southeastern Spain is deeply impressed on one by a flight along the coast.

which restrict its manufacture of aircraft, refuses authority to other nationals to fly across its borders, while France blithely continues to operate its air line between Strasbourg and Prague, trusting to careful management and a reliable engine to keep its equipment out of German hands.

This is a bitter legacy of the World War, a regrettable schism that only serves to aggravate international misunderstanding; but for those of us only momentarily involved, it appeared as an additional element of adventure, adding zest to our flight.

The many miles of the Black Forest crowding the German hills were still fresh in my memory, as were the softer slopes of the Vosges and the battle scars in the rich earth of the St. Mihiel salient, still obdurate before the patient reclamation of the French peasant's plow. The old imperial road leading through the Atlas Mountains to the orange groves of Algeria, which had been spread out beneath my winged observation platform but a few days before, now seemed a thousand leagues away.

It was hard to tear oneself away so



Photograph by Flandrin

AS AN AIRMAN SEES ALHAMBRA PALACE AT GRANADA, ONE OF THE PRICELESS CONTRIBUTIONS OF THE MOORS TO EUROPEAN ARCHITECTURE

The Moorish palace is to the right of the great arenalike structure (the Palace of Charles V) in the middle distance.

early from the quaint old city of Prague, redolent with the history and tradition of the ancient kingdom of Bohemia, of which the Czechoslovak Republic is the modern revival.

REGISTERED VOTERS ARE OBLIGED TO VOTE IN CZECHOSLOVAKIA

The frowning bulwark of the Hradčany, or Royal Castle, looks down across the green islets of the wide Vltava to the strange houses along the left bank, where the fusion of Italian baroque with the splendor of the Middle Ages captivates the eye. In this rich medieval atmosphere young Bohemia is hard at work building up one of the most progressive of modern democracies.*

In Czechoslovakia everyone entered upon the list of voters is obliged by law to vote, under penalty of fine or imprisonment, and the suffrage draws no distinction between race or sex, religion or station in life.

The Czechs are an industrious, progressive race, and for this reason, as much as any other, are not greatly loved by some of their more easy-going neighbors.

It is an interesting fact that the screw propeller, an essential element of the airplane which was to carry me swiftly across Bohemia this morning, was the invention of a son of a Czech customs official in Trieste, more than 100 years ago.

At the aërodrome we found two Spad planes waiting, as there were too many of us to accommodate in the usual one plane.

These winged carriers of the Franco-Roumaine are not the most comfortable of the modern European passenger planes, but they make up in part for their cramped quarters by cruising at a higher speed than the more commodious liners in use between London and the Continent.

The rounded semicylindrical body of

* See, also, "Czechoslovakia, Key-Land to Central Europe," by Maynard Owen Williams, in THE GEOGRAPHIC for February, 1921.

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GIBRALTAR, SEEN FROM THE NORTH

This is the familiar view of the great rock upon which Great Britain stands guard over the entrance to the Mediterranean (see also illustration, page 296)

Photograph by Flandrin

THE ROCK AND CITY OF GIBRALTAR AS IT APPEARED ON THE FLIGHT BETWEEN MÁLAGA AND TANGIER

The tiny strip of open neutral territory between British and Spanish land may be seen in the central background. For a detailed illustrated description of Gibraltar, see THE GEOGRAPHIC for August, 1924. One wing of the plane from which this photograph was made is visible at the left.

Photograph by Flandrin

THE INTERNATIONAL PORT OF TANGIER (SEE PAGE 287)

In the background may be seen the Riff hills, where Spain and the rebel Berbers have been engaged in conflict for many years. (See, also, the article by Harriet Chalmers Adams in this number of THE GEOGRAPHIC.)

Photograph by Flandrin

OVER CEUTA, IN SPANISH MOROCCO, AND THE SHORE LINE ALONG THE STRAIT OF GIBRALTAR (SEE TEXT, PAGE 287)

The strait between Europa Point and Ceuta is 12½ miles wide and the crossing by airplane consumes but a few minutes, as compared to a two-hour trip by boat.

the Spad has a closed compartment immediately behind the 400-horsepower Lorraine Dietrich engine, where three or four passengers may sit comfortably, if too many packages of goods of every variety are not being transported at the same time.

More modern planes now provide a separate compartment for commodities, with resulting increased comfort to the air traveler. In the rear of the passenger section are two cockpits, one for the pilot and the other for a mechanic.

By dint of much well-intentioned French with the field manager, who sat beside me in the bus during the ride out to the aërodrome, I was successful in getting this second cockpit allotted to me; so that a short half hour later, when we swept across the field and out over the Vltava Valley, I had the advantage of a vision of the surrounding country as unrestricted as that of the pilot close by my side.

THE BOHEMIAN COUNTRYSIDE IS A COLORFUL MOSAIC

One hundred and eighty-five miles across some of the most fertile farm land in central Europe, lay Vienna. In less than two hours we were there—two golden hours crowded with a kaleidoscopic succession of scenes and vistas that not even the master brush of a Corot could rival. If the long flight across Spain to Africa was the most spectacular, surely this all-too-brief trip across Bohemia was the most charming of my aërial travels in Europe.

Overhead, a flawless blue sky, like the image of a serene conscience; below, a marvelous mosaic of cultivated farms in all the ravishing colors of the harvest season. And such an infinite variety of patterns! Dark green-and-purple forest patches standing groomed and orderly; long, narrow, undulating strips of alternating green and gold and brown—new growth, ripening grain, and fresh, upturned earth; a score of greens; delicate shades of henna and silver-fox; gray and blue flashes of water; the white ribbons of roads lost for a moment in the cool shade of timber; tiny teams of oxen on the crest of a slope—while over all the dominant color theme of gold, the gold of the harvest.

It is little wonder that Bohemian character developed, in such a friendly environment.

With real regret I saw ahead the glistening Danube winding off through heavy woods toward Bavaria; then the pilot was calling my attention to a castle just below us. It was the famous castle of Kreuzenstein, set upon a knoll dominating the neighboring countryside, its moat now velvet-green, its battlements upflung in seeming challenge to the indifference of a flying age—a proud symbol of a cruel and chivalrous past.

There came flooding back all my boyhood memories of "Graustark" and "Men of Iron," and I was still lost in reverie when we glided down for a landing at the Aspern field.

PILOT ACTS AS GUIDE, USING PENCILED NOTES

In 20 minutes we were off with a new plane and pilot for Budapest. A heavy-jowled Hungarian, who had taken the place of the Americans who bade us good-bye at Vienna, shared the small compartment of the Potez plane with the Frenchman, who had come from Prague, and myself.

With true French courtesy, our pilot had thoughtfully prepared a scholarly typewritten description of the route, which was mounted on the bulkhead before us, and, together with a roll map case with which we had been provided, it served to shorten the 150 miles that separated us from the Hungarian capital.

As we passed over the old Roman arenas and the châteaux, our genial pilot would shake the plane controls to attract our attention, and several times during the hour and a half he thrust brief penciled notes of comment through the sliding window behind our heads.

But the first glow of the day's enthusiasm was gone, and, even with the pilot's energetic coöperation, could not be recaptured. My spirit was hovering above the Moravian Hills and refused to respond to the unimpressive vista of the broad and level Danube Valley, the yellow tide of the Donau Strom meandering between wooded, uncertain banks.

"A moitié chemin," read the pilot's note, and ahead we made out Komorn, a city half Czech and half Hungarian, at

Photograph by Flandrin

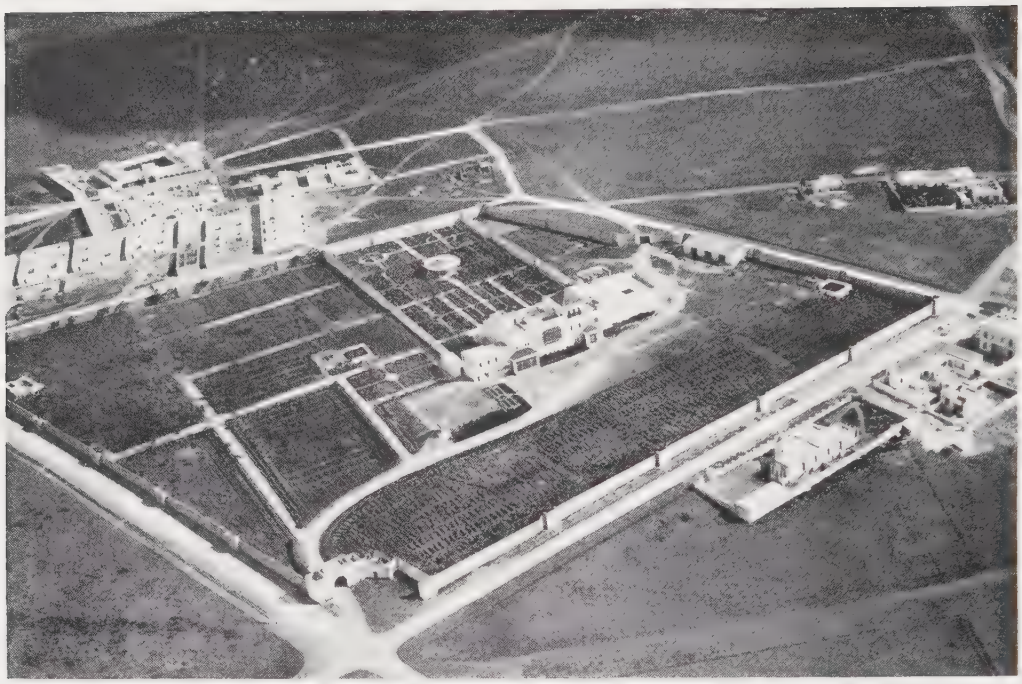
RABAT TO THE LEFT, WITH SALÉ, ACROSS THE BU REGREG, TO THE RIGHT (SEE TEXT, PAGE 287)

Rabat is the chief industrial center of Morocco, carrying on trade with Fez and the interior, with Gibraltar, Marseille, London, and Manchester, and is the official home of French control in Morocco. It was founded in 1184, at which time Salé was already an ancient city.

Photograph courtesy Lignes Aériennes Latécoère

AN AËRIAL VIEW OF CASABLANCA: MOROCCO

"We walk suddenly upon Casablanca, towering up over the artificial harbor, across the white and yellow houses and ocher-tinted towers. Here is the age-old, dimensional life of the East, a page out of the thousand and second tale of Scheherazade" (see text, page 287). Casablanca was built by the Portuguese, during the latter half of the 15th century, on the site of the once prosperous town of Anfa. Native uprisings eventually necessitated its abandonment. In 1907 the French bombarded the town in punishment for the murder of French and Spanish workmen engaged on the harbor works, and it has been occupied by the former since that time.



Photograph courtesy Lignes Aériennes Latécoère

THE SULTAN'S PALACE AT CASABLANCA

the confluence of the Waag with the Danube. Here the river turns somewhat northward to cut a tortuous course through some farflung foothills of the great Carpathian chain; so we left it, flying, as a bird flies, straight toward our goal.

THREE AIR SERVICES BETWEEN VIENNA AND BUDAPEST

The Hungarian seated behind me clutched my elbow to note something far below us at which he was excitedly pointing; it was another plane, a German seaplane flying low along the Danube, bound back along the course which we had just covered.

Between these two capitals of the former Dual Monarchy, Vienna and Budapest, there are three competing air services—French, German, and Hungarian. Each is subsidized by its country in an endeavor to develop a national aëronautical industry. Of the three, an unbiased estimate must yield to the Germans the best results with the greatest economy.

It was past the lunch hour when we landed at Budapest. Our Hungarian, now on his home ground, lost no time in bidding us adieu and disappearing in the direction of the city; but Monsieur and I had but a scant quarter of an hour to fortify ourselves before taking off in a fresh plane for Belgrade.

A mechanic pointed out the lunchroom, a small stucco building at the far end of a long row of shops and hangars, and to it we hastily made our way. A huge barefooted woman in a soiled calico slip was fussing about a stove, but our demands for food or drink of any kind or quality elicited only a curt, unintelligible response.

Having exhausted our best English, French, and German without avail, we were about to despair when an attractive girl appeared, evidently the daughter of our formidable and unkind opponent. She entered the lists in our behalf, and through her efforts we were supplied with a cup of black coffee and some buns.

Then came the question of paying: *dreissig tausend kronen,* 30,000 Hungarian crowns—a tremendous figure in prewar days, but modest enough, now that a dollar is equivalent to some 77,000.

But I had no Hungarian money, and neither had Monsieur. With praise-

Photograph from Levasseur

BEFORE THE GRAND MOSQUE OF ORAN

This religious edifice was erected by the Moslems to commemorate the expulsion of the Spaniards, in 1792. It was built with money paid as ransom for Christian slaves. Oran lies 220 miles east of Gibraltar and is the second city of importance in Algeria. An air line connects it with Casablanca, France's Moroccan seaport on the Atlantic, and continues on to Alicante, across the Mediterranean, and thence to Toulouse (see map, page 275).

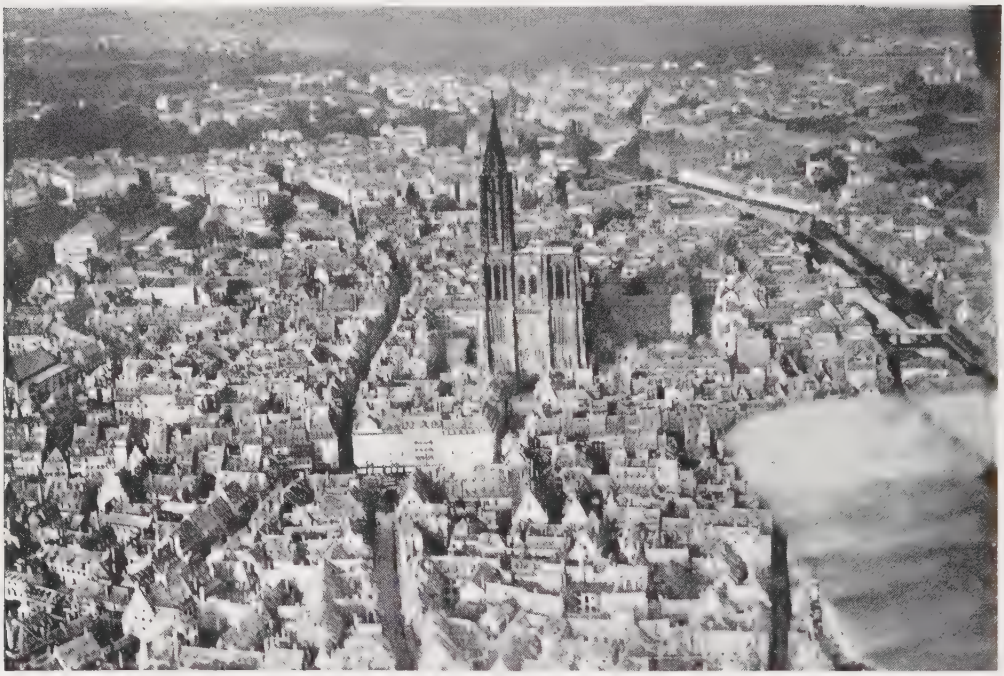
worthy foresight, Monsieur, before leaving Prague, had exchanged some francs for Rumanian lei against arrival in Bucharest, and I was prepared to settle our debts in the coin of at least five different countries. None, unfortunately, was current in Budapest.

"Let me see," I said to the fräulein in my best schoolbook German. "If 18½ French francs are worth an American dollar, and are therefore equal to 77,000 Hungarian kronen, and if 19 Czechoslovakian kronen are equivalent to 100 francs, I must owe you . . ."

At that moment the mechanic opportunely appeared to warn us that the plane was about to leave: I threw down the assorted paper bills in my hand and fled!

A WELTER OF EXCHANGE AND CONFUSION OF LANGUAGES IN CENTRAL EUROPE

It is a mystery how business can be



Photograph courtesy Lignes Aériennes Latécoère

THE CATHEDRAL AT STRASBOURG PRESENTS AN IMPOSING VIEW FROM THE AIR

Among the articles of commerce which are sufficiently valuable to be transported by airplane express is pâté de foie gras, for which Strasbourg is famous. This delicacy is shipped to Prague, Vienna, Budapest, and Bucharest by aircraft.

rationally conducted in this hodgepodge of states jostling each other between the Black Sea and western Europe. Currencies that before the World War were counted in digits now have meaning only in multiples of thousands. Relative values painstakingly learned to-day may become obsolete overnight. To this welter of exchange must also be added the confusion of a score of languages, a constant source of irritation and friction.*

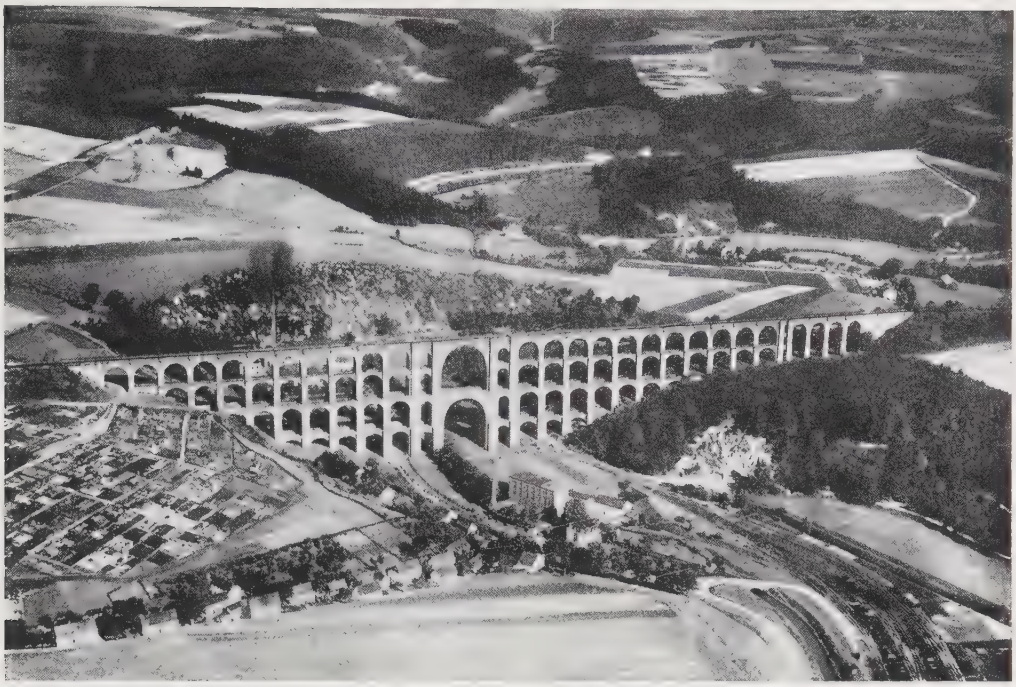
Small wonder, I mused, as our plane sped southward and the glitter of Budapest was dimmed by the haze on the horizon behind us, that this corridor between the Carpathians and the Alps should be the source of so much smoldering hatred and dispute.

There is, too, an even deeper antagonism here, for this is the meeting place of East and West, of indolence and secret privilege, with enterprise and aggressiveness. As the Moravian Hills are the watershed dividing the streams that flow westward from those leading to the Black Sea, so somewhere across this broad Danube corridor lies an invisible, intangible demarcation between the dominance of Eastern and Western ideals.

* See, also, "The Battle-Line of Languages in Western Europe," by A. L. Guerard, in THE GEOGRAPHIC for February, 1923.

A TURBULENT PASSAGE THROUGH A STORM

A sudden severe jolting of the plane, followed by a painfully familiar sinking sensation, forced my attention to the fact that we were rapidly approaching a big rain squall. For some time the pilot had been gradually reducing his altitude and, as we passed beneath the cloud rim, the level floor of the Hungarian plain lay but a few hundred feet below us, softened in the deep shadow of the storm. Fortunately, the squall was traveling our way and raced us along at 120 miles an hour. But the turbulent air was full of "pockets" and "bumps," and caused me to wonder after a time if my hasty investment at the Budapest lunch counter had been perhaps ill-advised.



Photograph by Deutscher Aero Lloyd

REMARKABLE VIEW OF THE RAILWAY VIADUCT NEAR CRIMMITSCHAU, FORTY MILES SOUTH OF LEIPZIG

When for any reason the engine of an airplane ceases to run, the plane does not fall out of control immediately, as is sometimes thought, but continues to fly, the source of power now being gravity, and the path of flight no longer horizontal, but inclined downward by a small angle. Modern transport planes travel forward 10 to 12 feet for every foot descent of altitude; so that if the plane is 2,500 feet in the air at the time of motor failure, it may glide from five to six miles in any direction from the point where the engine failure occurred. It is very rare not to find in a circle of area of this size any field in which the plane may be landed without accident to its occupants. Since the area of the circle increases as the square of its radius, and the radius of the circle available in which to make a forced landing is proportional to 10 or 12 times the altitude at which the plane is flying, it may readily be seen how great is the factor of safety when an airplane is flown at an altitude above a thousand feet or more.

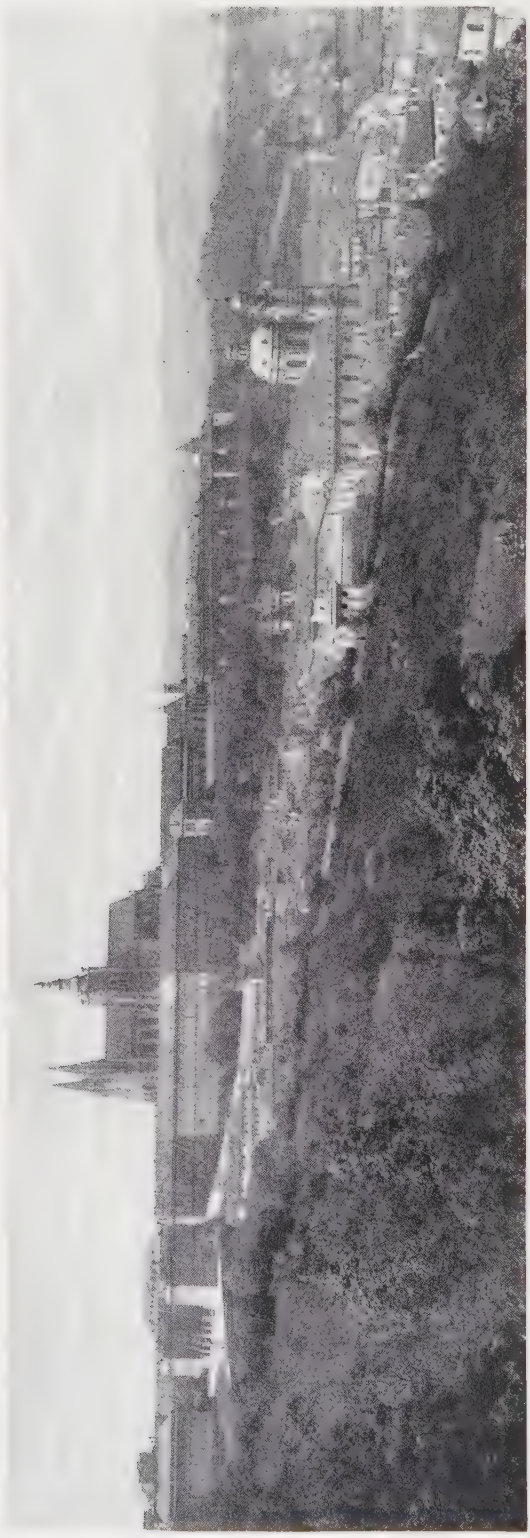
At Kiskunfelegyhaza we overtook the storm center, an awe-inspiring spectacle of Nature's pent-up fury unleashed on a hapless town. The rain lashed the gray roofs below us and ran in torrents through the narrow streets. The black spiral core of the storm threw out wraith-like octopus arms that reached down to the wet, gleaming earth, and clutched at us in sinister fashion as we slipped by to the south. But in 20 minutes we were out of shadowland into sunlight once more, the tumbled thunderheads behind us now gloriously white, towering 15,000 feet into the sky.

Occasional flashes of silver far away to our right betrayed the sluggish Danube making lazily for the sea, and the placid, level fields beneath our wing reflected the eternal youth and purity of Nature after a thousand partial corruptions.

I let my eyes close on this tranquil scene, in involuntary relaxation from the tension of our turbulent passage through the storm. The muffled roar of the engine beat less and less loudly on the drowsy senses, and when I awoke Pancsova aërodrome was rushing up to meet our wheels, with Belgrade at the wing tip across the shallow Danube.

PROCEEDING AT A "SNAIL'S PACE" OF 75 MILES AN HOUR

Five hundred and fifty air miles now lay behind us, while still some 280 miles to the east, beyond the frowning Transylvanian Alps, was our goal, the capital of Rumania.



Photograph by Rudo Bruner-Dvořák

THE FROWNING BULWARK OF THE HRADČANY, OR OLD ROYAL CASTLE, OF PRAGUE (SEE TEXT, PAGE 294)

There was no time to lose, as the afternoon was waning. Hence it was with disappointment that I noted our baggage being loaded into a large three-engined plane, whose obsolete lines gave evidence of an ancient, however honorable, vintage. This plane I darkly suspected could not cruise at much more than 75 miles an hour, at which rate we would be most of four hours and well after dark before reaching Bucharest.

The local field manager informed me that night-flying aids had been installed on the Rumanian section of the route, and that this was the "experimental" plane with which the test flights were to be made.

The announcement, however, failed to elicit any enthusiasm on my part. After traveling all day at nearly 100 miles an hour, the idea of poking along through the deepening twilight in this ancient crate at the absurd speed of 75 miles an hour was very annoying. It is curious how one grows speed-saturated in flying. Then, too, the sight of barefooted workmen tinkering about the high-strung aëronautical engines did not serve to quiet my uneasiness.

For one shamefaced moment I considered renouncing further flight that afternoon. After all, three countries should be enough for one day.

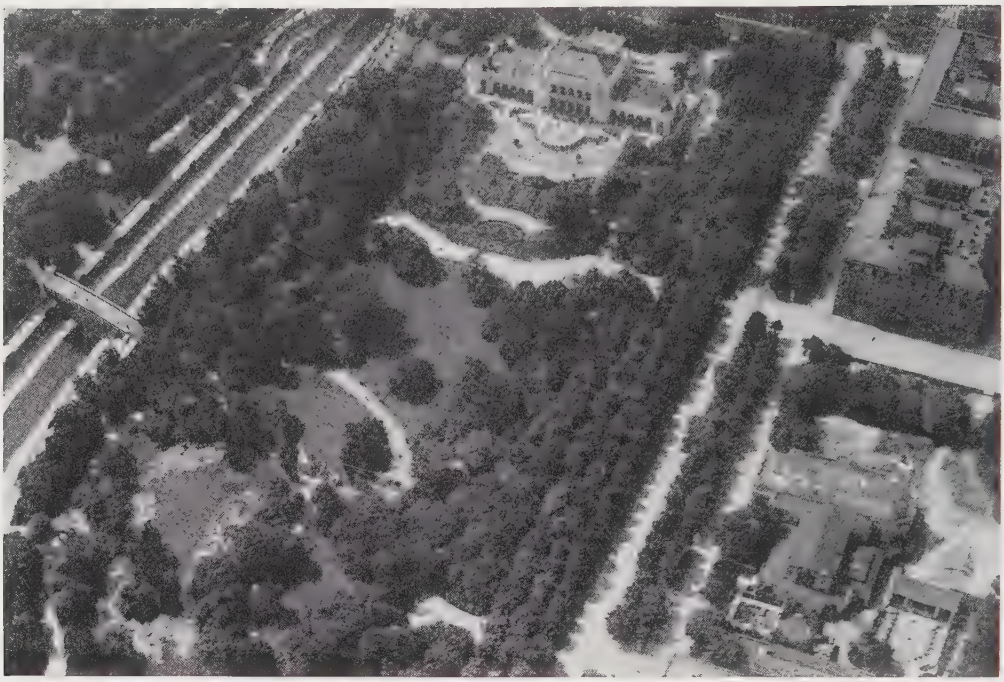
Then the thought of bargaining in some outlandish Serbian tongue for Yugoslavian currency stiffened me for the original venture. Besides, Monsieur, my French companion, had already nonchalantly taken his place in the passenger compartment of the big plane. I resolutely mounted the steps and took a chair by his side. There were accommodations for six passengers, but Monsieur and I were alone.

At the forward end of the cabin was a narrow door leading to the cockpit of the pilot and mechanic. A young French lad

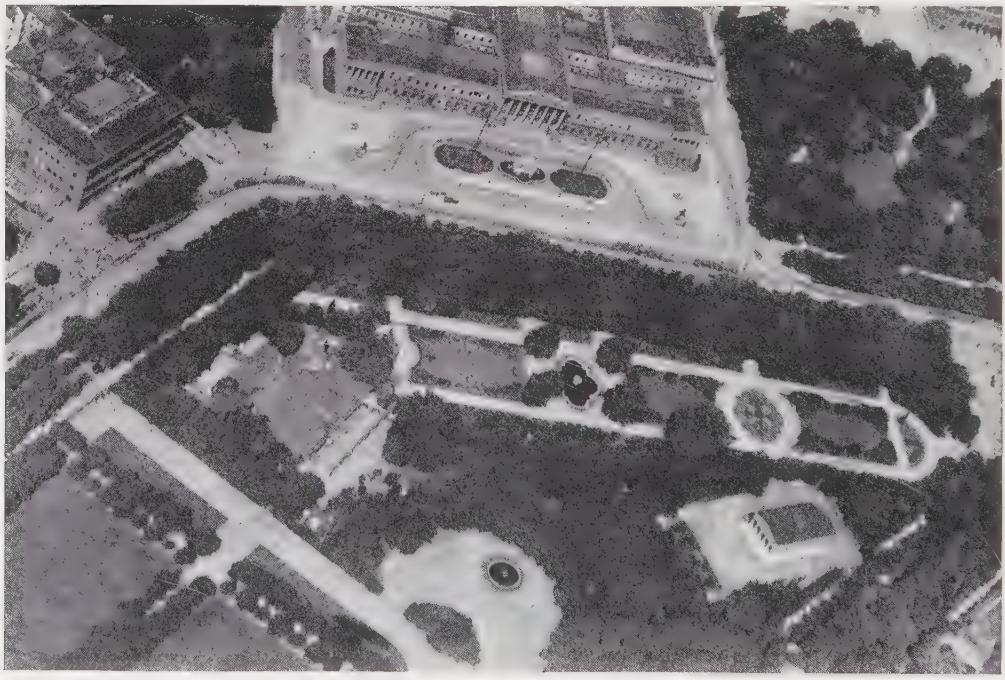
VIENNA, ON THE "BLUE DANUBE"

Photograph from International

"One hundred and eighty-five miles from Prague, across some of the most fertile farm land in central Europe, lay Vienna. In less than two hours we were there." [For a description of the Austrian metropolis since the World War, see "Vienna—A Capital without a Nation," by Selma Solano, in THE GEOGRAPHIC for January, 1923.]



VIENNA'S LOVELY STADTPARK, WITH ITS KURSALON (FOR CONCERTS)



Photographs from Keystone View Co., Inc.

THE AUSTRIAN PARLIAMENT BUILDING: VIENNA

This is one of the most beautiful modern examples of the classic style of architecture in Europe.

Photograph from International

AN AËRIAL VIEW OF HUNGARY'S CAPITAL

Budapest rivals Vienna for civic beauty and orderly arrangement of boulevard and street. Public squares, parks, and artistically planned drives abound. The Danube is seen in the right foreground. The magnificent building in the center of the picture is the Royal Palace, built by Maria Theresa in 1749-71 and restored after a fire in 1849. Many of its 860 rooms are now used for government offices.

in greasy jumpers and leather helmet wormed his way in backwards through this doorway to hand us our passports, which had been duly stamped by the local customs agent, and to ask if the messieurs would be so kind as to take the forward seats, as otherwise the plane would be too tail-heavy.

A COPPER TUBE CRACKS IN MID-AIR

My new position brought me directly beside the engine on the port wing, a Hispano-Suiza from which the cowling had been completely stripped, exposing an alarming number of slender connecting pipes and complicated-appearing accessories. Was it a trick of the isinglass through which I was peering that made that long copper tubing along the base of the crankcase appear to vibrate so badly? Some barefoot workman must have failed to secure it properly.

With a deep-throated triune roar, the big plane plunged across the sandy field and staggered into the air. For the first time in 4,000 miles over the air lines of Europe I was distinctly uncomfortable. That copper tube vibrating in the 75-mile wind held my uneasy attention fixed.

Then I saw it crack. From the broken end there streamed out, under pressure, a liquid which I prayed was only water, but darkly suspected was gasoline. I scrambled up to open the door before me and nudged the mechanic, whose broad back obscured the passage. He took one look and crawled forward hastily to notify the pilot.

In another minute, with engines throttled, we were circling back from the Transylvanian foothills to the Pancsova field, fortunately not yet many miles to the rear.

Half an hour later we were off again, in the same plane, the offending tube having been replaced by a new one that had

Photograph by Erdelyi

THE KITCHEN OF A FAMILY OF THE MIDDLE CLASS IN THE NEIGHBORHOOD OF BUDAPEST

The author, on page 302, tells how such a young Magyar came to his aid and enabled him to buy black coffee and buns near the flying field at Budapest. Owing to the confusion of languages and rates of exchange, the difficult problem of payment was one which had to be solved arbitrarily.

Photograph by Ewing Galloway

THE OUTDOOR PUBLIC MARKET IN BELGRADE, CAPITAL OF YUGOSLAVIA

The Panscova aërodrome, the only scheduled landing field between Budapest and Bucharest, is across the Danube from Belgrade. Formerly the capital of Serbia, Belgrade, after the World War, became the seat of government of the Kingdom of the Serbs, Croats, and Slovenes, with three times the area of old Serbia and with a population of 12,000,000.

OVERLOOKING BUCHAREST, THE "PARIS OF THE EAST"

"That evening, through my window, there floated up the staccato music of hoof beats to the accompaniment of endlessly tinkling silver bells, as the youth of Rumania rode out behind dark-robed Russian cabbies" (see text below).

been secured under the supervision of the chief mechanic. This was the only instance in all my European air travels when a flight was interrupted or delayed by mechanical trouble.

It is curious that it should have occurred in an aircraft equipped with several motors expressly for the purpose of avoiding unpremeditated landings. It would seem that often the presence of additional engines, rather than acting as a further safeguard, actually may multiply the possibilities of interruption, and that the wisest insurance is to employ only the best equipment, maintained at the highest standard of skilled workmanship.

A broad white cloud lay brooding upon the outposts of the Transylvanian Alps, as we swept east 1,000 feet above, and the Danube swung in a wide arc to the south, searching an outlet through this last barrier to the sea. The brown Serbian plain was lost behind us in the glare of the late afternoon sun, while pine-clad, tumbled ranges below us reached up through broken clouds.

A strong wind at our upper altitude urged us forward, but it was already dusk when we crossed the deep-cut gorge at the Iron Gate and bade good-bye to the Danube at Turnu Severin, where it debouches upon the Wallachian plain. An hour sped by and waves of darkness crept down from the mountains massed along our left to flood the fertile fields and drown the last steely glint of the evening sun on the little streams hurrying toward the Danube, now marking the Bulgarian frontier far to the south.

Friendly lights rubbed at the tiny windows in dark wooded patches on the plain, a beacon flare winked eagerly from an emergency field below, inviting us to explore its welcome; then a dull glow against the sky, a checkerboard of myriad flashing signals, and Bucharest lay beneath our wing, a great searchlight spreading its yellow glare upon the Băneasa aërodrome.

That evening, through my window on the Calea Victoriei, there floated up the staccato music of hoof beats to the accompaniment of endlessly tinkling silver bells, as the youth of Rumania rode out

THE POTTERY MARKET IN PITESTI, NORTHWEST OF BUCHAREST

behind the dark-robed Russian cabbies to mark the quiet stars.

Royalty had withdrawn weeks before to the cool seclusion of the near-by foothills; but the street life of the city still throbbed on. Barefoot peasants along the narrow lanes jostled soldiers in slovenly uniform; a gypsy girl in brilliant scarf and rainbow-colored skirt chatted gaily with a group of bearded, dark-skinned men; above the steady rumble of the street rang out the sharp crack of a Russian whip and the warning cry of a muzhik.

DANZIG CAUSES MANY COMPLICATIONS AND HEARTBURNINGS

The unfamiliar sounds lent color to my fancy, and at length, as I fell asleep, there seemed to be spread out before me the whole great length of the Danubian watercourse, with the massive Carpathian chain and the Transylvanian Alps sprawling across it, like a sinister question mark, a symbol of the uncertain destiny of this strange, unstable land.

Seven hundred and fifty miles northwest of Bucharest, as the crow flies, lies Königsberg, the capital of East Prussia, near the shores of the Baltic Sea. An easy day's flight if one cares to make it so, but I chose the more leisurely way, revisiting the capitals that had been little more than glimpsed on the outbound journey, and thence by air via Warsaw to the quaint old city of Danzig, near the mouth of the broad Vistula.

The creation of the Free City of Danzig must have seemed like an ingenious solution to a vexing problem for the weary conferees at Versailles in the spring of 1919. But conceive, if you will, of the City of Galveston cut off from the rest of Texas by a Mexican "corridor," its customs controlled by foreigners. Can you imagine the populace any other than wildly American in sentiment, its people restive and unhappy?

Thus, in Danzig 93 per cent of a population of some 400,000 are Germans, isolated on the one side by the Polish corridor, separated on the other from their relatives and business relations in East Prussia by restrictive customs regulations. Everywhere one meets two customs officers: the Danzig "Free" City agent who takes your money, and the Polish officer who relieves the Danzig agent of it.

Photograph by J. Bulhak

A RELIGIOUS FESTIVAL IN FRONT OF THE CATHEDRAL AT WARSAW

Trains from East Prussia to Germany go through Danzig locked, with Polish guards patrolling the vestibules. It becomes as great an offense to get off a train without permission as to board it without a ticket.

SEABATHERS PARTICIPATE IN A CUSTOMS WAR

One of the amusing aspects of this customs war developed on the shores of the Gulf of Danzig, whither the townsfolk spread during the hot summer afternoons to enjoy a dip in the Baltic or to promenade along the beach.

Zoppot, the Monte Carlo or Coney Island for Danzigers, boasts a pretentious Palace of Sans Souci, which for many years has attracted a host of summer visitors from the Polish hinterland. With a foothold on the Baltic shore, Poland determined to build its own seaside resort; and a rival to Zoppot came to life at Gdingen, just across the invisible wall of the corridor. Here the visitor was to be lured and Zoppot humbled by the simple expedient of a costly visé penalty to any Pole whose preference led him to Free City territory.

But sabotage commenced. Bathers who entered the water innocently enough at Gdingen left it at Zoppot. Guards were stationed at the corridor wall, like "offside" referees at a football game. Finally an overzealous agent shot an Englishman who, while swimming without his

Photograph by Jan Bulhak

THE ROYAL PALACE AND STATUE OF KING SIGISMUND III: WARSAW

Warsaw is an important aviation center, one air line running to Prague, another to Danzig, a third to Lemberg, and a fourth to Krakow. The variety of articles which have been shipped by air is astonishing—everything, from live frogs for experimental purposes, to steel plates needed to complete some contract job. A bear has been shipped from Moscow to the zoo at Berlin; a registered Jersey cow traveled by air from Amsterdam to Paris; a race horse subject to seasickness crossed the Channel by air.

THE CHURCH OF ST. MARY: DANZIG

Begun in 1343 and completed in 1503, St. Mary's is one of the largest Protestant churches in existence. Its massive tower, 248 feet high, is surrounded by ten slender turrets on gables.

Photographs by Deutscher Aero Lloyd

PART OF THE MEDIEVAL FORTIFICATIONS OF DANZIG SEEN FROM THE AIR

Ramparts, bastions, and wet ditches formerly surrounded the entire city, but 30 years ago they were removed from the north and west sides, the trenches filled in, and the area thus freed was laid out on a spacious plan. Much of the great city retains its picturesque medieval character, however, with narrow, winding streets, lofty and elaborately ornamented gables, and balconied windows (see text, page 313).

Photograph from Lieutenant J. Parker Van Zandt

A PLANE ARRIVING AT KÖNIGSBERG FROM MOSCOW WITH SOVIET DIPLOMATIC MAIL

The landing of this plane marked the inauguration of the joint German and Russian passenger and freight air line between Moscow and Königsberg, Prussia. The Soviet Government owns 50 per cent of the stock of the Deruluft Air Company, which operates a daily service connecting Königsberg with Kovno, Smolensk, and Moscow.

monocle, had inadvertently crossed the line, and the English High Commissioner appointed by the League put an end to firearms.

The horrors of this guerrilla warfare were duly impressed on my mind one savage rainy night while traveling by train between Danzig and Königsberg.

Under the circumstances of this article I hesitate to confess my presence on a train, but it really wasn't my fault. Three days before I had wired from Warsaw to reserve a place on the air line, only to be informed that all seats between Danzig and Königsberg were booked for more than a week.

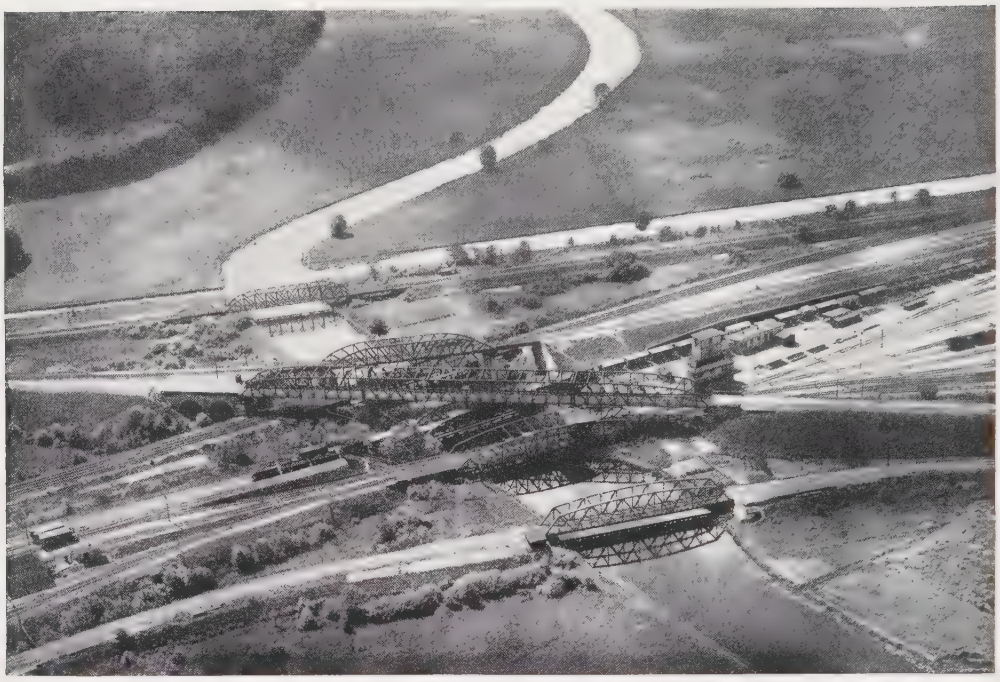
This heavy traffic had seemed a little surprising, but the explanation was not long in forthcoming. The main railway artery, which reaches Danzig from Stettin and continues into East Prussia, passes through the little city of Dirschau at the bridgehead across the Vistula, some 40 minutes out of Danzig. And Dirschau is Polish.

A glance at a map of Europe* reveals the territory of the Free City imbedded like a third molar in the Baltic jaw represented by the Gulf of Danzig, while between its roots lies Dirschau, the strategic railhead for all east-west rail traffic.

Each time a citizen of Danzig wishes to visit his cousins, let us say, in Marienburg, East Prussia, not much more than an hour's train journey away, he must pay $10 for a Polish visé for the privilege of riding five minutes through the narrow apex of land in which Dirschau lies; and in all probability he will have his baggage opened by four different customs officers—that is, unless he circumvents the whole nagging system by traveling by air.

There is an air taxi service at Danzig advertising "Zwanzig Minuten nach Marienburg" (Twenty Minutes to Marienburg), for which, needless to remark, Dirschau is not an intermediate stop; and

* See the National Geographic Society's New Map of Europe, published as a supplement with its Magazine for February, 1921.



Photograph by Deutscher Aero Lloyd

RAILWAY CROSSINGS IN GERMANY, NEAR STETTIN

The value of aërial photography in studying traffic and highway problems is suggested by this view. The French occupation of the Ruhr created an unusual condition at Cologne, where German merchants were practically shut out from all outside markets except as they could be reached by air. As a result of this embargo, very heavy freight shipments were recorded between London and Cologne, including 55 motorcycles and 100 tons of tobacco. For a time the German Government resorted to shipping German paper money into Cologne by sending it first to London by airplane and thence by air back across the Channel into Cologne. This proved highly satisfactory for their purposes until one plane, loaded with many billions of paper marks, had the misfortune to make an emergency landing in a French zone, and thereafter the shipments ceased.

there are busses which will carry one as far as Königsberg—without crossing Polish territory.

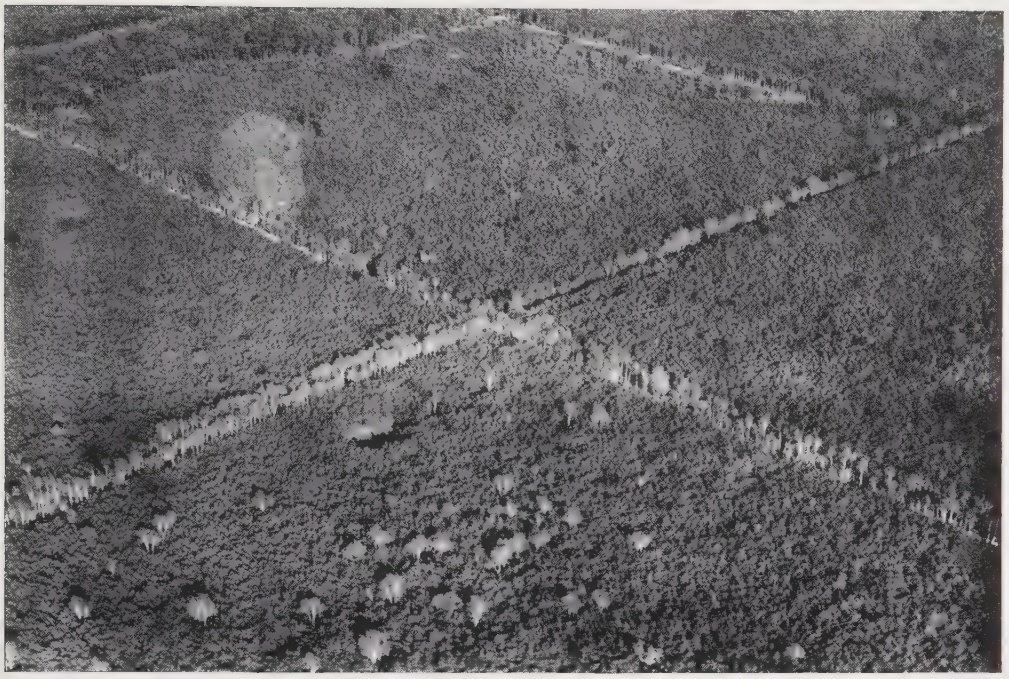
I reached Dirschau late at night on my enforced train journey, without a special Polish visé, the dismal light of the long platform revealing the steady downpour of an early autumn rain on the sodden streets beyond. For ten minutes my fate hung gloomily in the balance, while a score of customs officials cross-examined me and pondered whether or not to leave me with my baggage under the dripping eaves.

Finally a kindly Pole, with whom I had struck up a casual acquaintance, assured the unfriendly agents I was a *bona fide* American diplomat, and that grave international dissension might arise were I detained.

Thus I was permitted to continue, after being strongly warned to procure an additional Polish visé before attempting to return. Of course, I earnestly agreed to do so, with the mental proviso that I would not soon again wander so far from the friendly freedom of air travel.

THE PROSPECT OF A RACE OF AËRIAL COMMUTERS

In contrast with this harrowing tale, the journey back to Danzig by air was idyllic. It was early morning, and the rising sun threw splashes of color on the green meadow through scattering clouds that overhung the Königsberg field. The Nord Europa Union monoplane to Riga and Helsingfors was the first to get away; then the big liner for Smolensk and Moscow, carrying the Russian courier and several hundred pounds of diplomatic mail (see page 317).



Photograph by Deutscher Aero Lloyd

FOREST CONTROL BY AËRIAL PHOTOGRAPHY

The German Government and municipalities exercise a close control over the forest districts under their jurisdiction. The accompanying picture illustrates the use of aërial photography in the study of different types of growth and in recording the development of young timber.

A few minutes later we took off in a metal limousine plane, scudding before a following wind across the ivy-covered university where Kant once taught.

The streets were bedecked with flags for the anniversary of von Hindenburg's defeat of the invading Russians in the swamps of East Prussia. Most of these flags were the old imperial black, white, and red; here and there, occasionally, the symbol of the new democracy—black, red, and gold, the flag of the revolutionists of 1848—was rather furtively displayed.

Where the Pregel empties into the landlocked finger bay of the Frisches Haff, the sun withdrew for a time behind a misty wall and "the hooded clouds, like friars, told their beads in drops of rain." A beautiful rainbow loop formed beneath us, thrown out, as it were, from our whirling propeller and curving upward to our opposite wing tip, like a magic golden ring, through which we sped above the sandy strip along the Baltic shore.

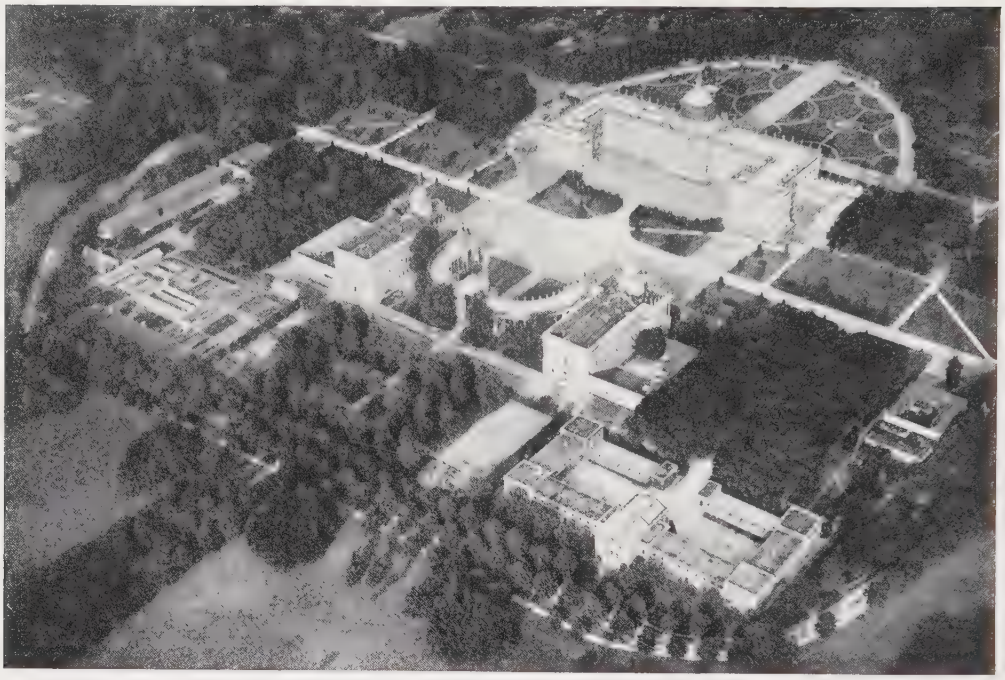
The muffled roar of the engine penetrated but little into our comfortable cabin, and my German traveling companions engaged earnestly in some business conversation, wasting few glances on the placid scenes unrolling beneath our feet.

It may be, when a race of aërial commuters has been created, that many will fly, as they say in the "Bhagavad-gītā," like a spoon through soup, without perceiving the flavor thereof. But flight is an esthetic experience, as the quickening spectacle of Nature must always be, "full of a serious sadness and a large peace."

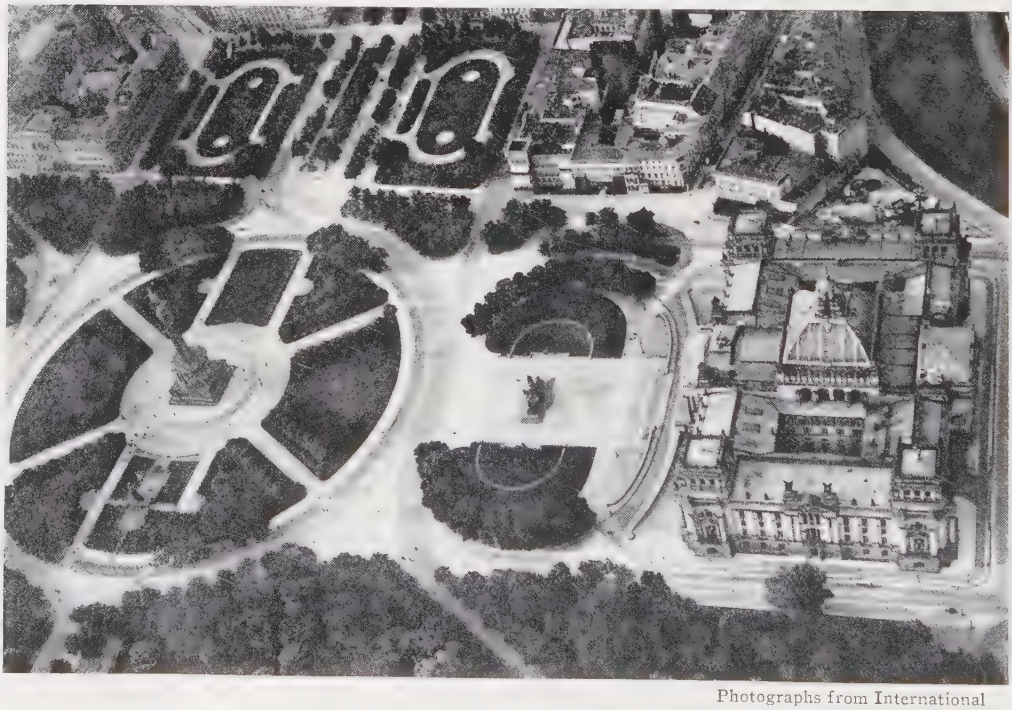
AIRCRAFT TO PLAY IMPORTANT RÔLE IN ENRICHING LIFE

The toy fishing vessels rolling in the trough of a Baltic wave; the tiny figures of fishermen on the white sand stretching out their dark nets; sudden silver gleams from wheeling gulls; the rich green meadowland edging the blue lagoon—such scenes stir the fancy and enrich the mind.

Indeed, aircraft are destined to play an important part not only in the ordering, but in the enrichment, of life; for they



THE EX-KAISER'S FORMER PALACE AT POTSDAM PHOTOGRAPHED FROM THE AIR



Photographs from International

THE HOME OF THE REICHSTAG, IN BERLIN

To the left is the Königsplatz, photographed from the German passenger dirigible *Bodensee*.

Photograph by Deutscher Aero Lloyd

LOOKING DOWN UPON THE BRANDENBURG GATE, TOWARD THE TIERGARTEN, FROM AN AIRPLANE ABOVE UNTER DEN LINDEN: BERLIN

The city of Berlin has recognized that its present airport at Staaken, 12½ miles out, is too far from the center of the city, and it has donated Tempelhofer Feld, a military parade ground only a few minutes by taxi or street car from Unter den Linden, to be made into a municipal aerodrome. Among the European peoples, the Germans seem to take most naturally and readily to air travel, then the Dutch and English, and last of all the French. Nevertheless, of the four countries, the French Government is spending considerably more than any of the others to encourage and build up a commercial air transportation industry.

contribute to our control over our environment, which is the fundamental value of all natural science.

In an hour the red-tiled roofs and narrow streets of Danzig lay beneath us, the massive monument of the Church of St. Mary, with its "Dunkle Giebel, hohe Fenster" towering above its neighbors (see illustration, page 316). We glided down for a landing at the Langfuhr municipal field, to await the connecting plane from Warsaw before pushing on to Berlin.

Reflection upon esthetic experience must often remain abortive or incoherent, yet there is one quality I would express

Photograph by Royal Dutch Air Service

THE CENTRAL STATION OF AMSTERDAM, WITH THE HARBOR IN THE BACKGROUND

The Zuider Zee may not always be one of the charming sights of a flight between Berlin and Amsterdam, the commercial capital of Holland. Dutch engineers are busily at work planning to shut off this inland sea and to pump much of it dry, thus adding another large section to the portion of Dutch territory now below sea level. If this project is successfully carried through, the little island of Marken may lose its unique character as a bit of the old Holland where native costumes are still worn, and its sanctuary will be violated by passing automobilists.

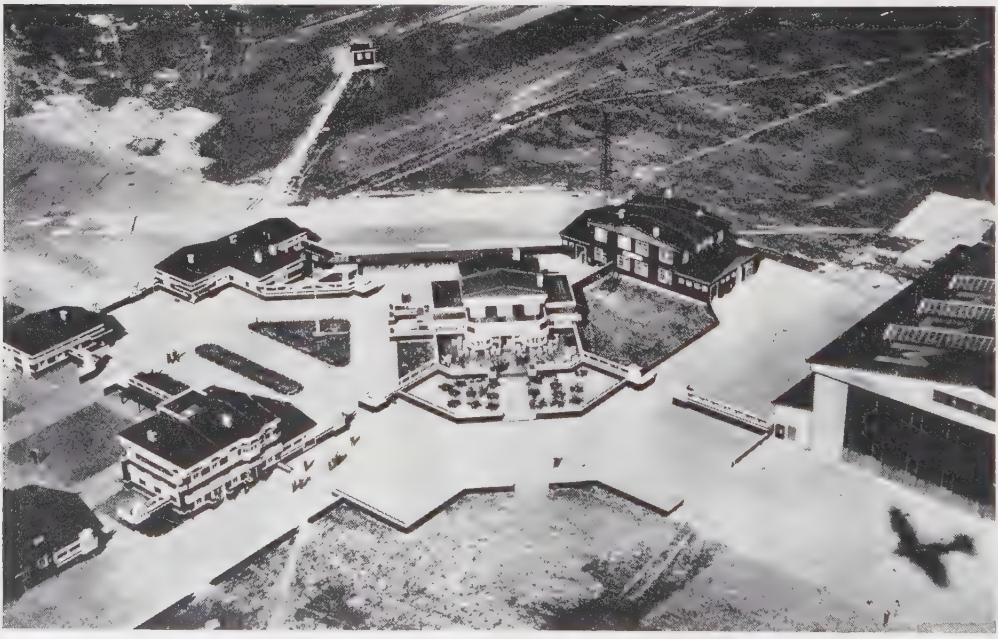
A VIEW OF THE RIVER MAAS (MEUSE) AT ROTTERDAM

Photograph by Royal Dutch Air Service

The fleet of tugboats in the right center is engaged in towing a dry-dock beneath the two bridges. With more than half a million population, Rotterdam is second only to Amsterdam in size among Dutch cities. It handles more than 60 per cent of the shipping of Holland.

Photograph by Royal Dutch Air Service

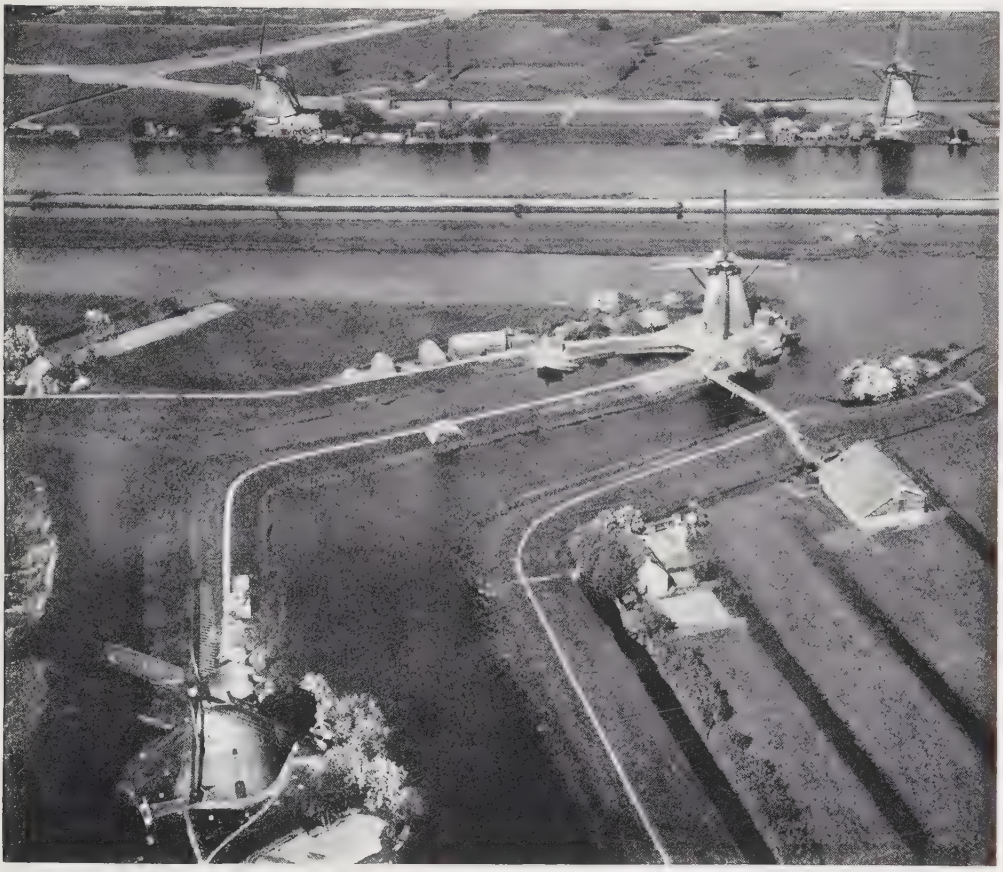
SAILING RACES NEAR ALKMAAR, NORTH OF AMSTERDAM



Official Photograph, U. S. Army Air Service

AN AËRIAL VIEW OF THE MUNICIPAL AIRPORT AT ROTTERDAM, HOLLAND

In the center may be seen the hotel and restaurant. This field was established and constructed wholly at the expense of the municipality, on reclaimed ground, in connection with its port development projects, and is one of the model aërodromes of Europe. Note the shadow of the plane in the right foreground.



Photograph by Royal Dutch Air Service

A VIEW OF POLDERS (SECTIONS OF ARTIFICIALLY DRAINED LAND) AND WINDMILLS NEAR RIDDERKERKE, IN THE NEIGHBORHOOD OF ROTTERDAM

if I could. The freedom of flight represents in a real, objective sense a partial removal of the ordinary checks and restraints that normally impose themselves between our will and our actions, between impulse and event. There is a temporary harmony with one's environment where momentary preference may be indulged without opposition.

This is, of course, only a limited freedom, but it is, nevertheless, a partial, however elemental, approach toward that adequacy and perfection which is commonly designated as omnipotence. In this fact may lie some explanation of the deeper esthetic satisfaction that lingers long in the memory after a particular flight is past.

But "to feel beauty is a better thing than to understand how we come to feel it."

It is September and I am in London again, having flown over from Amsterdam this morning, across the dikes and tulip beds of Holland, with a company of Dutchmen in a monoplane, thus completing 6,500 miles of looking down on Europe. Europe is big, but not so big that with such a vantage the mind cannot retain a vision of the whole line and contour of it—a vibrant, living picture.

A VISION OF EUROPE

One learns without conscious effort the geographical origin of so much of Europe's history; the inevitableness of misunderstanding and conflict where political lines have been flung recklessly across mountain and watercourse, now throttling an isolated valley, now barring an ancient people from their natural outlet to the sea.

There comes flooding back the vision of castellated battlements along the Dan-

Photograph from Lieutenant J. Parker Van Zandt

AN ELEVEN-SEATER COMMERCIAL AIRPLANE EQUIPPED WITH A 450-HORSEPOWER NAPIER ENGINE

This is a type of plane used in the air service between London and Berlin, Cologne, Brussels, and Amsterdam. Freedom from breakage and theft is an important factor contributing to the growth of air express traffic on European air lines. Fragile goods, vases, and other articles are dispatched by air in order to be sure of careful handling. Insurance rates covering all risks on shipments such as dresses, furs, jewelry, fragile goods, light machinery, etc., between London and the Continent are less by air than by boat or rail. Much gold and silver coin and metal is shipped by air across the Channel. One plane, for example, from London to Amsterdam carried two million dollars' worth on a single flight.

ube bank; of castles nestling in the German hills; of châteaux, half hidden in poplars, stepped up like organ reeds against the warm colors of the French countryside; of ripening grain on the Moravian slopes under a late afternoon sun; and of the bold, free sweep of the Mediterranean, stretching out in tranquil beauty to an unreal horizon.

But the real, luminous beauty of Europe seen from above cannot be phrased. It is there, now happily within the reach of every arrant lover of living, this precious gift bestowed by flight. But the deeper wonder of it is of the nature of things which talk does not easily pursue; in the end it remains something incommunicable, irrational, and final.

ACROSS FRENCH AND SPANISH MOROCCO

By Harriet Chalmers Adams

Author of "Adventurous Sons of Cádiz," "A Longitudinal Journey Through Chile," "Rio de Janeiro, in the Land of Lure," etc., etc., in the National Geographic Magazine

IT WAS a spring evening when our train from Oran, in western Algeria, rolled into the town of Ujda (Oudjda), just over the French-Moroccan border. We were entering this land of romance and mystery by the back door. The new front door is at Casablanca, chief harbor of the Protectorate on the Atlantic seaboard (see map, page 331).

It had been our intention—my sister's and mine—to sail from Oran to Gibraltar and down to Casablanca. Souli Mohamed was responsible for the change of plan.

Souli Mohamed is the smiling, white-turbaned Moor who fills the trying post of head porter at the hotel in Oran. It was he who suggested the Ujda route.

"Fez? Yes, I know it," he told me in Spanish. "It is the home of my father. From Fez to Casablanca there is now a railroad—fine, big cars, like the ones which run from Oran to Ujda; but between Ujda and Fez there runs only a very narrow train, on which none but the soldiers may ride. Why do not the Señoras travel by automobile from Ujda to Fez? The barber across the street will sell them tickets."

That settled it. We had bought stamps at the tobacco shop and gluten bread at the chemist's, but it would be a new experience to buy automobile tickets from the barber.

Monsieur-the-barber came from Bordeaux and spoke only French. Madame, his pretty, plump wife, a Jewess of Oran, spoke Spanish, the tongue of the Jews of Oran and of many of the Children of Israel native of North Africa.

This automobile service, we learned, was maintained by Madame's brother in Ujda. It was a "jitney" line, in no way connected with the big French company, the French touring cars, or the chain of French tourist hotels operated throughout North Africa. We were, in fact, the first foreign travelers to apply for passage. The line was patronized by Moors and Algerians, by Oran Jews and an occasional French commercial traveler. We should meet no tourists and many natives.

And the motor cars? *"Très, très bonne,"* Madame assured us. There was triweekly service, she said, and each passenger could carry 60 pounds of luggage. It required one long day's travel from Ujda to Fez. Should she make the reservation by telegraph? . . . It was agreed. We went back to the hotel to pack the most of our luggage for shipment by sea to Gibraltar.

ORAN IS BECOMING AN AFRICAN CHICAGO

Oran, 261 miles west by rail from Algiers, is on its way to become an African Chicago. Distinctly modern in appearance, despite its rich historical background, it is rapidly gaining commercial importance in the export of cereals, wines, olive oil, cattle, and hides. The Oran Bay, which once knew corsair galleys and for three centuries sheltered Spanish craft, is to become Algeria's chief naval base.

Back of the city lies a fertile agricultural region settled by French colonists; and still farther back, beyond the high plateau, that little-known division of French Africa called the Southern Territories. To the northern edge of this arid hinterland the Algerian State Railway has penetrated, to and beyond the palm-studded oases of Figig (Figuig) and Colomb Béchar, more than 400 miles inland from Oran, on its arduous way across the vast Sahara to the French Sudan.

It is difficult to realize, even in this age of swelling empires and shifting frontiers, that Greater-France-in-Africa is to-day 20 times larger than France-in-Europe. Second in size comes Great Britain, with a territory 30 times larger than the British Isles.

Before starting across French Morocco, let us take a panoramic view of its land and sea boundaries. Beginning on the east and swinging around the circle, we have: Algeria, French; Southern Territories (really the northwestern Sahara), French; Rio de Oro and Ifni, Spanish; the Atlantic Ocean; Spanish Morocco;

Photograph from Levasseur

AFTER A SNOWSTORM IN THE OUTSKIRTS OF TLEMÇEN, ALGERIA

With an elevation of 3,000 feet above sea level, Tlemçen is a health resort, popular among the French residents of the North African coast.

and a bit of the Mediterranean Sea, where French Morocco "comes up to the blue" between Spanish territory and French Algeria.

Were we to fly over the country, looking down on its sloping coastal plains, snow-capped mountain chains, and stretches of tawny desert, we should see that the ranges of the Atlas, higher here than in Algeria or Tunisia, traverse it from southwest to northeast, protecting the northern temperate region from the hot winds of the Sahara.

West to east through the Spanish zone, paralleling the Mediterranean, extends the maritime chain of the Atlas known as the Riff. It is through a depression between the Riff Range and the Middle Atlas that the road from Ujda to Fez runs. Ages ago, before the existence of the Strait of Gibraltar, the waters of the Atlantic flowed through this depression to mingle with the waters of the Mediterranean.

French Morocco, which the French call *Maroc,* is, roughly, the size of the State of Texas; Spanish Morocco, known to the Spaniards as the *Marruecos,* is about as large as Massachusetts. Up in the northwest corner, nearly encircled by Spanish territory, is an area more than twice the size of the District of Columbia

STRANGE PARTNERS TILLING THE FERTILE SOIL OF NORTHERN ALGERIA

South of Oran lies a productive agricultural region settled by French colonists, but farther back, beyond a high plateau, lies the little-known division of French Africa known as the Southern Territories.

given over to an international zone. Here Tangier lies.

FIELDS OF NARCISSUS, IRIS, AND MARIGOLD GROWING WILD

I should like to follow the spring longitudinally up and down the world! When the leaves are falling in Argentina and South Africa, it is blossom-time in the United States and along the Mediterranean.

Spring had come in a flash to western Algeria as we journeyed those eight hours by rail from Oran to Ujda. The terra-cotta soil contrasted pleasingly with the verdant fields. Vineyards alternated with grain fields and orchards, the fruit trees a perfect glory of white, pink, and mauve. The almond is indigenous to this country.

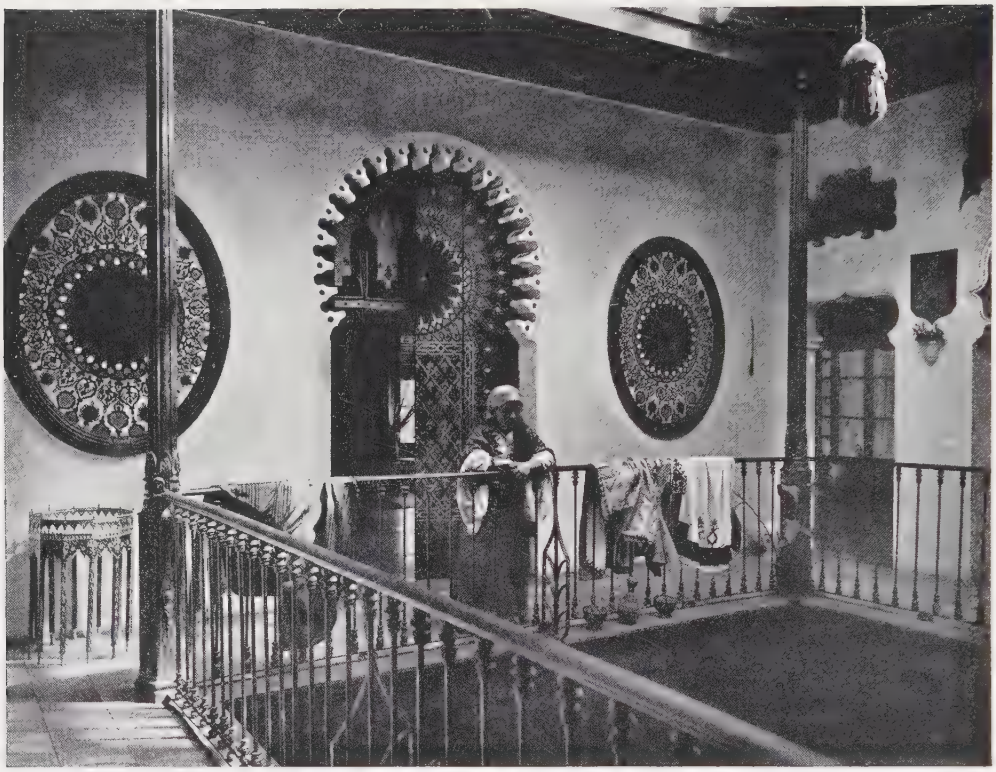
And the wild flowers! I had read that in the springtime Morocco is carpeted with wild flowers, and this magic carpet, it seems, stretches eastward into Algeria. There were bluebells and slender pink lilies, starry daisies and brilliant marigolds. Lupine grew beside the red-pink clover. There were marshes gay with purple iris and fragrant white narcissus, which we cultivate at home.

Turbaned farmers, in flowing white robes, were at work in the fields. I saw a type of haystack new to me, plastered with mud as a protection from rain. In shape it resembled the ancient Mayan buildings seen in southern Mexico and Central America—pyramidal, built up in steps. Perhaps it is Berber in origin and has survived the series of invaders—Phœnician, Carthaginian, Roman, Vandal, Arab—who drove the earliest agriculturists to the hills.

Near the native villages, with their blank white outer walls and their inner courtyard walls of vivid blue, lay the creamy red-tile-roofed villas of the French colonists. Paralleling the railroad track ran a gleaming white metaled highway, as well built as any road in France.

ALGERIA HAS BECOME ALMOST A PART OF FRANCE ITSELF

In the dining car, at luncheon, I saw two young Algerians wearing European



Photograph by York and Son

THE UPPER STORY OF A MOROCCAN HOUSE

clothes and red fezzes, drinking native Royal Kébir wine. Across from them sat a stately old Arab, in snowy robes and high turban, sipping black coffee, too good a Moslem to drink wine or spirits in any form.

Up, up we climbed toward the plateau, with charming vistas back on this new agricultural France-in-Africa, so closely linked with the motherland by fast steamer from Marseille. After nearly a century of French rule, Algeria is virtually a part of France itself, sending representatives to the government in Paris. Here military officials are subordinate to civilians. Morocco, so recently brought under French control, has, as we shall see, a very different status.

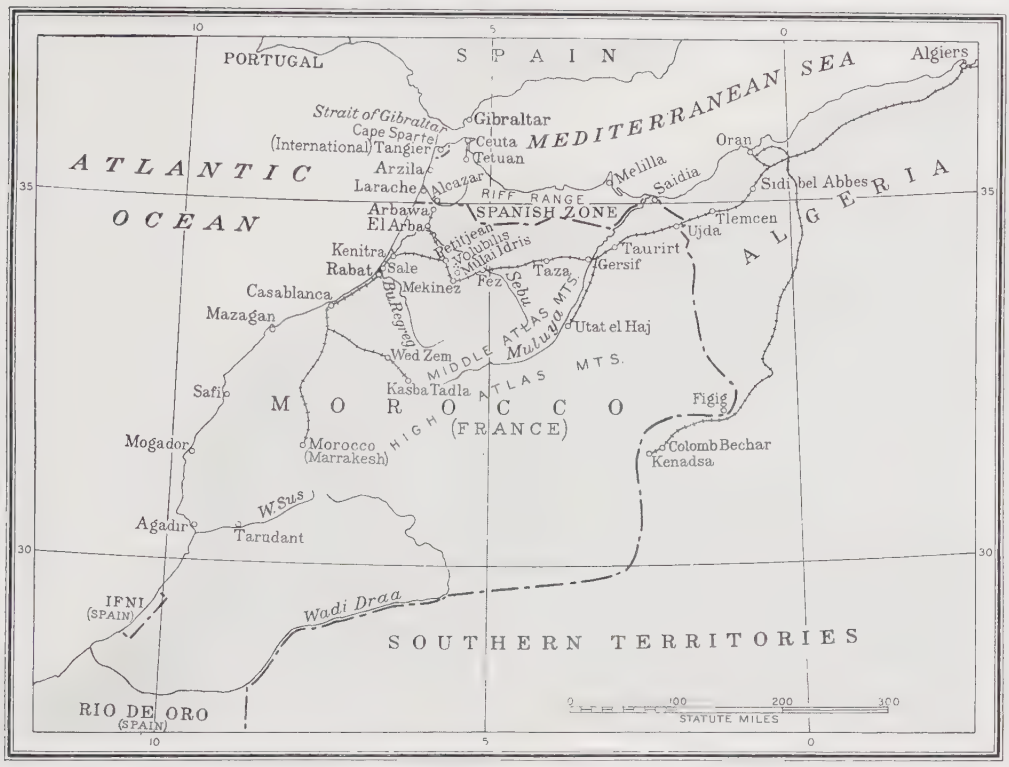
TWO TOWNS PERMEATED WITH THE SPIRIT OF HISTORY AND ADVENTURE

The two Algerian towns that stand out in my memory of that day's journey from Oran to the Moroccan frontier are Sidi-bel-Abbès and Tlemçen.

The former is one of two Algerian depots of the Foreign Legion. Here men of varying nationalities—French, British, Russian—left the train on the last stretch of their journey to join a service full of hardship and adventure. For years no other ties might claim them.

Tlemçen, although within Algerian territory, is Moorish in its history and architecture—a pure type of Islamic town. Set on a hillside 3,000 feet above the sea, surrounded by olive, carob, and terebinth trees, the native city looks down on the outspread French settlement and over the plain which stretches to the Mediterranean. Near by are strewn the massive red-walled ruins of bygone civilizations.

Here the Romans camped. From here they marched, over the road we were to follow, to found their westernmost military post and granary at Volubilis, beyond Fez. Here, nearly twelve centuries ago, the followers of Mulai Idris, founder of the first Mussulman dynasty in Mo-



Drawn by James M. Darley

A MAP OF FRENCH AND SPANISH MOROCCO

The author traveled from Oran, on the coast of Algeria, to Ujda by rail; from Ujda to Fez by motor; from Fez to Casablanca by rail, and from Casablanca, by way of Rabat, Kenitra, Arbawa, Alcazar, Larache, and Arzila, to Tangier. French Morocco is about equal in area to the State of Texas, and Spanish Morocco is the size of Massachusetts.

rocco, built a city near the deserted Roman camp.

To Tlemçen, from the west, swept the Berber hordes who conquered Spain. For this pearl of El Moghreb el Aksa, "Farthest West" of the Moslem world, the Spaniards of Oran and the Turks of Algiers fought, and the Turks won. Then came the French.

From the station in Ujda we made our way by automobile to the little hotel across the street from the "jitney" garage. We were to start at four in the morning!

AN EERIE ENTRANCE INTO OLD MOROCCO

Half a dozen small boys hung to the running board, jabbering Arabic and laying hands on our luggage. Neither Spanish nor French proved effective, but the brother-in-law of Monsieur-the-barber came to our rescue with a club.

I cannot describe Ujda. It was dark when we entered it and dark when we left it. Our start on the long day's journey was made before daylight, in a torrential downpour. No more eerie entrance into Old Morocco could be imagined. The shadowy figures passed on the highway in the gray dawn—hooded, shrouded in ghostly white, creeping along with their flocks or prodding their laden donkeys—seemed to belong to an age long past.

The realization came to me that these secluded people, who, until a few years ago, had not dreamed of a world beyond their archaic hills, nor seen a wheeled vehicle, had been brought, in one great leap, face to face with civilization in its most advanced stage—the railroad, the automobile, the airplane.

I had a feeling of gratitude that we had not come to inland Morocco too late. Here, little changed since prehistoric

days, were the ancient Berber people. Here, right in the automobile with us, were natives taking their first ride!

I have met travelers who have journeyed under more comfortable circumstances to Fez. I cannot agree with the wife of Monsieur-the-barber about her brother's automobile being *très, très bonne*. It was, in fact, the most uncomfortable and unreliable "jitney" it has ever been my misfortune to encounter (see illustration, page 343); but, to an inquiring geographer, our fellow-passengers were all that could be desired.

A MOTLEY GROUP OF PASSENGERS

On the front seat, next to the French-Algerian driver, sat a commercial traveler, a modern Jew from Oran, with whom we spoke in Spanish. He knew Arabic, but, like ourselves, was ignorant of the native Berber tongue spoken throughout Morocco. Next to him sat an altogether different sort of Jew, one of the Old Testament type, whose ancestors drifted to North Africa along with the Phœnicians, a thousand years before the birth of Christ. His name was Shimo.

Unlike the Jews descended from Spanish exiles in the days of the Christian-Moslem wars, he knew no Spanish and only a few words of Arabic. I think he spoke a mixture of ancient Hebrew and the Berber tongue. He wore flowing garments, like the Moors, but his outer cloak was dark-blue instead of the Moorish white or brown. On his head was a high, brimless, black felt cap, shaped like the red fez worn in most Moslem countries. This cap was covered with a strip of the white muslin which was also wound about his neck.

With us, on the middle seat, sat a woman traveling alone. We judged her to be a blend of French-Algerian, Turkish, and Berber. She wore European clothes, was unveiled, spoke French, and said that her husband was a merchant in Ujda. It was through her knowledge of the Berber language that we became acquainted with the three men who occupied the back seat.

They were Berbers and looked and dressed alike. Their skin was swarthy, features rather flat, eyes small and brown. They wore black pointed beards, in the Moslem fashion. Loss of beard is the greatest humiliation that can be put on a devout Mohammedan.

Their shaven heads were wound, turbanlike, with strips of creamy cloth, and flowing *djellabas* of cream-colored woolen homespun enveloped them. This hooded garment is of Berber origin. Heelless slippers of lemon-colored leather encased their bare brown feet.

They would have nothing to do with the old Moroccan Jew, whom they called "Jehudi." He was not a True Believer. He, in turn, ignored them. The two strange foreign ladies they called "N'zrani" (Nazarenes) and seemed greatly to admire my sister's golden-brown hair.

They told the lady from Ujda that this was their first motor ride; that they liked it, but wished they were in front, where it was easier to jump out.

Language may be the closest link toward better acquaintance; but when a laden automobile skids into the ditch there is no further need of formality. We met with three such experiences between Ujda and Taza, where the splendid metaled highway begins. Up to this point we followed the *piste*, or dirt road—in reality nothing more than the old caravan trail, widened and somewhat improved.

TRAVELING SAFELY ALONG A LANE BETWEEN HOSTILE TRIBESMEN

We were crossing a newly conquered country. The road parallels the narrow-gauge railway which brings the soldiers to the forts along the line. These little white forts, guarding highway and railroad, are placed at regular intervals, with larger garrisons between.

Some 30 miles to the north are the rebellious Riff tribesmen, not yet subdued by Spain (see page 355); some 30 miles to the south are the remaining Berber tribesmen, not yet on good terms with the French; yet through this narrow lane, between enemy lines, the traveler can go in safety—that is, if he chooses a good automobile and a careful driver.

Fortunately for us, the dirt road, very muddy and uneven that day, merged with the hard, rough desert. When we came to grief in the mud, we took to the desert. It was not the type of wilderness we had pictured, of sand dune and mirage. This lies beyond the Atlas. Here were cacti

WHITE TANGIER FRAMED BY A COBALT SEASCAPE

Phoenicians, Carthaginians, Romans, Arabs, Portuguese, English and French have occupied this, the oldest place of recorded habitation in Morocco. It is extremely difficult to take "snap-shot" natural-color photographs, but the sky was so clear here that the camera artist succeeded in making this instantaneous exposure from his steamer.

© Autochromes Lumière by Gervais Courtellemont

THE HOUR FOR TEA IN FEZ

The chief beverage of the Moroccans is served very hot and very sweet, flavored always with mint. The principal native dish of the country is *couscous*, a kind of dry porridge made of ground wheat stewed with mutton or chicken and pieces of pumpkin.

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Autochromes Lumière by Gervais Courtellemont

A LEATHER MERCHANT OF RABAT

Morocco has given its name to a fine quality of goatskin which is tanned with sumac or subjected to chrome tanning and dyed on the grain side. The process is supposed to have been invented by the Moors. The famous Cordova leather of Spain is also a Moslem industry.

JEWISH WOMEN OF FEZ

The shawl, a badge of the Jewish woman, is frequently costly, an heirloom coming from the Far East. This mother and her daughter wear no stockings, but their feet are incased in the heelless leather slippers which are worn throughout Morocco.

©

A MOROCCAN DAUGHTER OF ISRAEL

There are two types of Jews in Morocco—those whose ancestors came from the East in early Semitic invasions, and those descended from the Jews of Spain who reached Africa when and after the Moslems were expelled from Europe. These latter speak an ancient Spanish dialect.

Autochromes Lumière by Gervais Courtellemont

A BERBER MAID FROM THE ATLAS MOUNTAINS

The Berbers are the original Moroccans, who were driven into the mountains by succeeding invaders—Phoenicians to Moslems. This young girl is wearing a white woolen homespun garment, and her people's traditional headdress which suggests the casque of the ancient Greeks.

A JEWISH CLOTH MERCHANT OF FRENCH MOROCCO

It is estimated that the Jews of French and Spanish Morocco number only about 150,000, but they play an important part in the life of both countries, for they are the chief merchants and money lenders of the cities.

© Autochromes Lumiere by Gervais Courtellemont

PRESIDING OVER A SAMOVAR IN MARRAKESH

French Morocco boasts four capitals—Fez, Mekinez, Marrakesh and Rabat—in each of which the Sultan has a palace. The seat of government, however, is at Rabat.

APPRENTICES IN ILLUMINATION

In this native school of arts and crafts, in the old Moorish quarter of Rabat, children are taught to paint the old Arab designs, familiar in Granada and Seville, in gold and blue and vermilion.

© Autochromes Lumiere by Gervais Courtellemont

JEWISH AND MOSLEM WOMEN AT THE FEZ HOSPITAL DISPENSARY

While the Moslem women are veiled, the Jewish women invariably cover their heads. Beneath the white woolen outer garments of the former, bright-colored cotton gowns are worn.

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Autochromes Lumière by Gervais Courtellemont

THE TOWN PALACE OF A LORD OF THE ATLAS

The French have permitted several powerful chieftains of mountain tribes to live in regal splendor in Fez and Marrakesh, while they retain control of their followers. The fountain shown here is similar to those found throughout Moslem Spain.

MUSICIANS AND DANCERS AT A BANQUET IN FEZ

Besides the oriental dances, given to the accompaniment of violin, lute, tambourine, flageolet, flute and drum, there are occasionally graceful sword dances by barefoot highland Berber girls. Note the superb mosaic tilework here and in the illustration to the left.

©

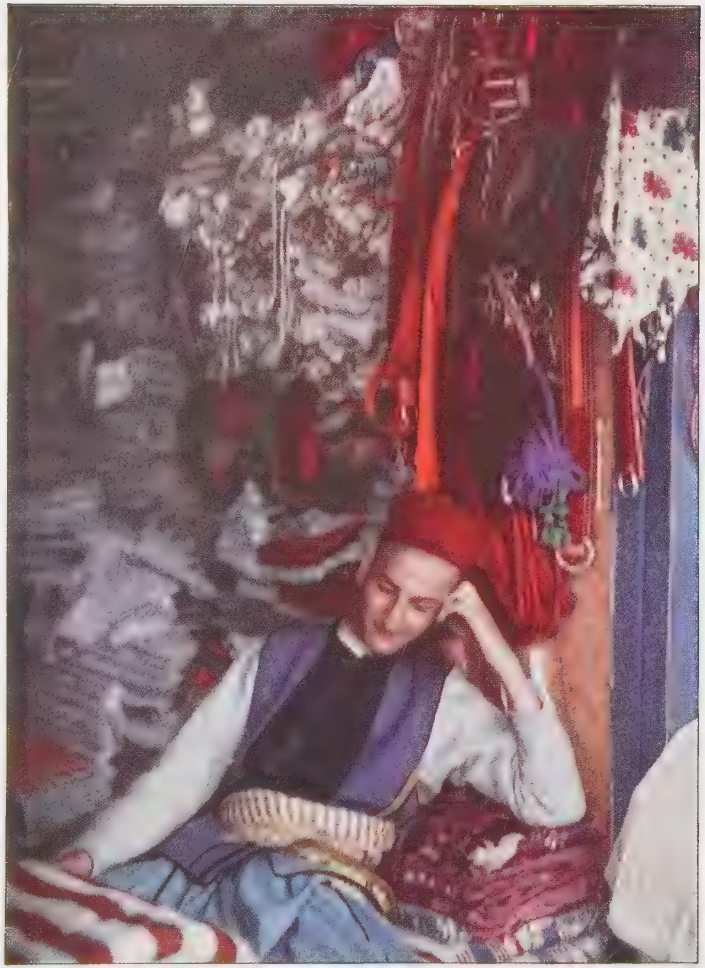
AN ARABIAN-NIGHTS TYPE IN MOROCCO

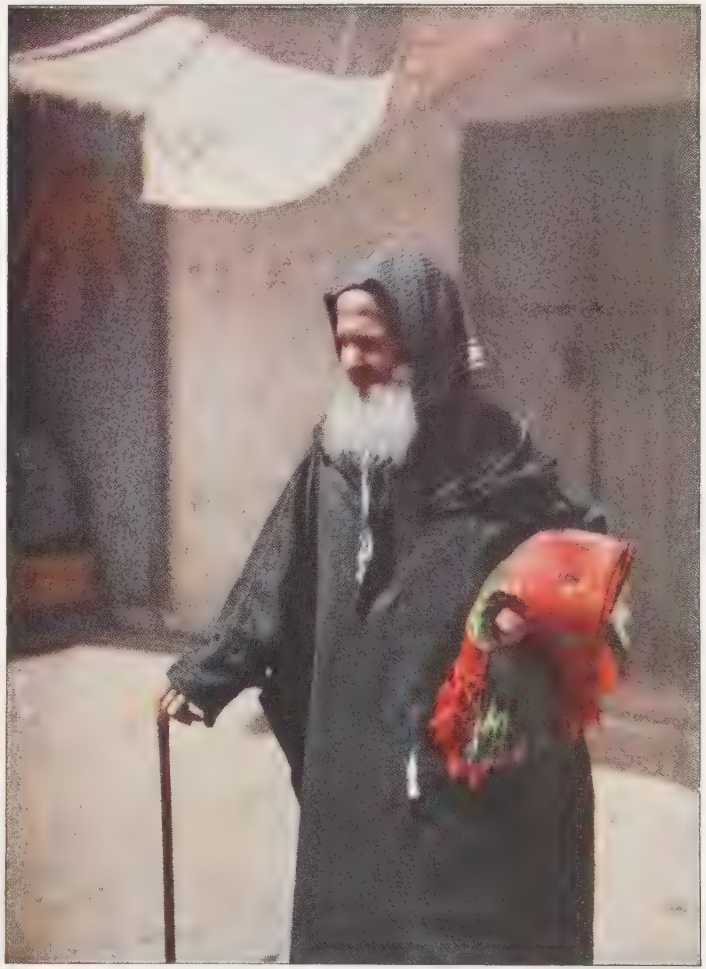
Like the snake charmer, the sweetmeat seller, and the musician, the story-teller is a part of Eastern life which has a strange fascination for the Westerner who lives in Arab lands.

Autochromes Lumiere by Gervais Courtellemont

A RABAT DYER OF RUG YARN

The colors of the famous Rabat rugs are burnt orange, mahogany, brown, green, a little cream and dark coral. The floors of the mosques are carpeted throughout with many rugs.





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A LANGUID MERCHANT OF CASABLANCA

His shop is a mere cubby-hole in the wall, set waist-high above the street. He sits cross-legged by the hour among his wares—cinches for horses, saddle blankets, rainbow-hued silks and gay-colored cotton cloth.

A JEWISH CLOTH PEDDLER

Before the French came to Morocco, the Jews were compelled to show their subjection to the ruling race by their dress and were required to take off their shoes whenever they passed a saint's tomb.

and a scanty vegetation on which gaunt camels grazed.

These single-humped Arabian camels are not the "oldest residents" of Morocco. They followed the Arab invasion westward twelve centuries ago. Before their coming, the domesticated ass was the Berber's only beast of burden. Long years before the birth of the Great Camel Driver who gave to the Moslem world its faith, long years before the Three Wise Men journeyed to Bethlehem, Berber farmers here drove their asses to market and Berber shepherds here tended their flocks.

SHEPHERDS WEAR LOCK OF HAIR AS PASSPORT TO HEAVEN

At our first breakdown on the lonely road, out of sight of forts and soldiers, we were surrounded by these primitive plateau people. Not yet arrived at the opulent state of their countrymen on the back seat of the automobile, these poor shepherds wore brown homespun djellabas, ragged and soiled. Although nominally Moslems, wearing the usual prescribed head-covering, their women were unveiled.

The faces and ankles of these Berber women were tattooed. They were taller and leaner than their harem-bred sisters whom we later met in the cities where Moorish beauty runs to avoirdupois.

The heads of the young boys were uncovered, showing a long strand of hair on the otherwise shaven head By means of this strand, the Jew from Oran informed us, the Faithful are jerked up to heaven.

We passed the homes of these shepherds—low black cloth tents of woven camels' hair surrounded by thorny brush walls. At night the sheep, goats, and donkeys are brought within the inclosure.

In Morocco there are more sheep than people. Barbary flocks are not driven, as in most parts of the world, but follow the shepherd, who calls to his sheep as he would call to little children. Perched on rocks, with their flocks about them, the half-clad Berber boys play the most mournful tunes imaginable on their ancient pipes.

At the village of Taurirt we had coffee at a café kept by a Frenchman. A starry-eyed, tame gazelle, called "Bizette," followed him about the room. The Atlas Mountains are still a haven for many wild creatures. Here roams the pale-brown aoudad, intermediate between sheep and goat, with big, wild eyes, large horns curving backward and downward, and long whitish hair drooping from throat, chest, and forelegs.

We crossed the broad Muluya River on the railroad bridge. Morocco is drained in three directions. Rivers, whose headwaters in the Atlas are within a limited circle, flow to the Atlantic, the Mediterranean, and the Sahara, the last-named streams being lost in the thirsty sand. The Muluya flows northeast from the Atlas to the Mediterranean, where it forms the boundary between French and Spanish territory.

Like the Sebu River, flowing from Fez to the Atlantic, it can be canalized, a French engineer told me, over much of its course. The French are negotiating with the Spanish in regard to the building of a port near the Muluya's mouth.

THE GIANT-FRAMED SENEGALESE ARE ENCOUNTERED

Near the village of Gersif (Guersif) we met the first of the Senegalese troopers. Of all the soldiers of France's mighty colonial army—Frenchmen, *Légionnaires*, Arabs, Berbers, and black men from many an equatorial clime—none are braver than these giant-framed ebony-skinned men of Senegal. Within the walled military inclosure at Gersif we saw the dwellings of these warriors—circular adobe huts with conical thatched roofs, not unlike the sort they have at home.

On the white wall of every fortified railroad station along this route two signs, in large, black letters, point the direction to the "Ville Indigène" and the "Ville Nouvelle." It is thus, from the first, made apparent to the traveler that the French have built their towns *outside* the native villages. They are not interfering with Moslem architecture, religion, or customs. They have built railroads and highways; have fortified those regions unsubdued even in pre-French days; have erected hospitals and schools; but Mussulmans and Jews are kept apart

Photograph by Frederick Moore

MAKING DAY HIDEOUS WITH HIS HOWLS: A SINGING MINSTREL OF MOROCCO

in the hospitals, the schools are on Moslem lines, and even the courts of justice are administered, under French supervision, by native pashas.

In Morocco a Pasha dispenses secular justice in a city, a Kaid governs a tribe, and a Kadi administers the Moslem law based on the Koran.

"The Moors are not an inferior, but a different, race from the French. We want them to become good Moors, not poor Frenchmen," Marshal Lyautey, Resident-General of Morocco, has said; and "Lyautey Africanus," as an American statesman once called him, is the very soul of this French Maroc.

From Gersif the road climbs to the terraced hill town of Taza, boldly commanding the Touahar Pass, the natural eastern boundary of Morocco, which looks a little like the Khyber Pass, between the Northwest Frontier Province of India and Afghanistan.

Like the Khyber, this pass has known hard fighting. Men of the Stone Age fought here, and men of the Bronze Age. Here marched the Roman legions. Here through the centuries flocked the Berber hordes, swaying east and west.

Twenty years ago Taza was the headquarters of Bu Hamara, a fierce bandit who held out against the Sultan. In Fez I saw the small cage in which he was exhibited on a camel's back, between his capture and his death, throughout the neighboring country.

At Taza, in the spring of 1914, the French forces from Fez met the French forces from Algeria and the tricolor waved across North Africa.

A SPLASH OF WHITE—THE HOLY CITY OF MOROCCO

The beautiful part of our day's journey was from Taza on. The blue Riffian hills to the north were without snow, but to the south the peaks of the Middle Atlas lifted their crystal-crowned heads to the cobalt sky. In the emerald bottom lands below the road sleek cattle grazed. Far ahead, on a distant hillside, we saw, through the twilight haze, a splash of white. It was our first glimpse of Fez.

I have seen strange and fascinating cities—kaleidoscopic La Paz, on the roof

Photograph by Harriet Chalmers Adams

UJDA TO FEZ BY AUTOMOBILE

In addition to the author and her sister, the car, which was driven by a French-Algerian chauffeur, had as passengers a modern Jew of Oran, another Jew of the Old Testament type, a woman traveler of French-Algerian, Turkish, and Berber blend, and three Berber men.

of the Western World: remote inland towns of Asia, Moscow in pre-war days, and many another ancient mart—but none is more alluring to Western eyes than this long-hidden Holy City of Morocco, seat of Moslem learning for more than 1,000 years. I am glad I saw it in springtime, when it lay like a pearl on the slopes of the velvet-green hills.

Fez is a compact, white-robed city of uneven flat roofs and unexpressive walls. From among these roofs rise the minarets of the mosques, which here are not slender, round towers, like those farther east, but square in shape, like the well-known Giralda of Seville. It is the great crenelated outer ramparts surrounding the city which give to it, and to every Moroccan town, that air of enchantment and mystery (see page 344).

Shading in color from terra cotta to ocher, nearly golden in some lights, interrupted by massive watchtowers and by an occasional gatetower with a horseshoe arch, these immutable walls of Old Fez fascinate the Westerner, lingering in the memory after other more animated scenes have faded.

Breaking the monotony of these walls within walls, built in days when Moroccan cities were perpetually menaced, are the smiling fields and gardens which encircle the town and the glimpses of secluded gardens within, where cypresses, pomegranates, apricots, and oleanders shade the jasmine and the rose.

DARK TALES ARE TOLD OF FEZ

I shall always connect this curious city with the sound of running water. Through it, and under many of its streets, rush mountain torrents. In the eyes of the Moor still water is unclean. The remarkable drainage system under the town is said to have been the work of a French renegade who lived here at the close of the eighteenth century. Dark tales of other days are whispered—a lid in the conduit lifted, a thrust—who knows!

Fez has four distinct divisions: the Medina, or native town; the Mellah, or Jewish quarter; the Sultan's palace and

Photograph by Captain Paul Martel

A VIEW OF OLD FEZ TAKEN FROM THE TOMBS OF THE ANCIENT MERINIDE SULTANS

To the north of the city are great sections of reddish ruined walls, ancient ramparts built in the twelfth century. To the right is the minaret and square-pointed roof of the mosque venerated throughout all Morocco, the Mulai Idris. To the left the minaret of the Mussulman University of El Kairouine, celebrated throughout North Africa.

grounds; and the new French city outside the walls.

The native city is divided, in turn, into Djedid, the upper town, and El Bali, the lower, older section. In Djedid are palaces and gardens, some abandoned. One of these palaces is now used as a French hotel.

El Bali is a labyrinth of dark lanes flanked by buildings windowless save for barred slits in the upper stories; and crowded alleys, roofed with reeds and palm branches (see page 345), where merchants sit, cross-legged, in cubby-hole bazaars waist-high above the street, smoking *kief* in long reed pipes.

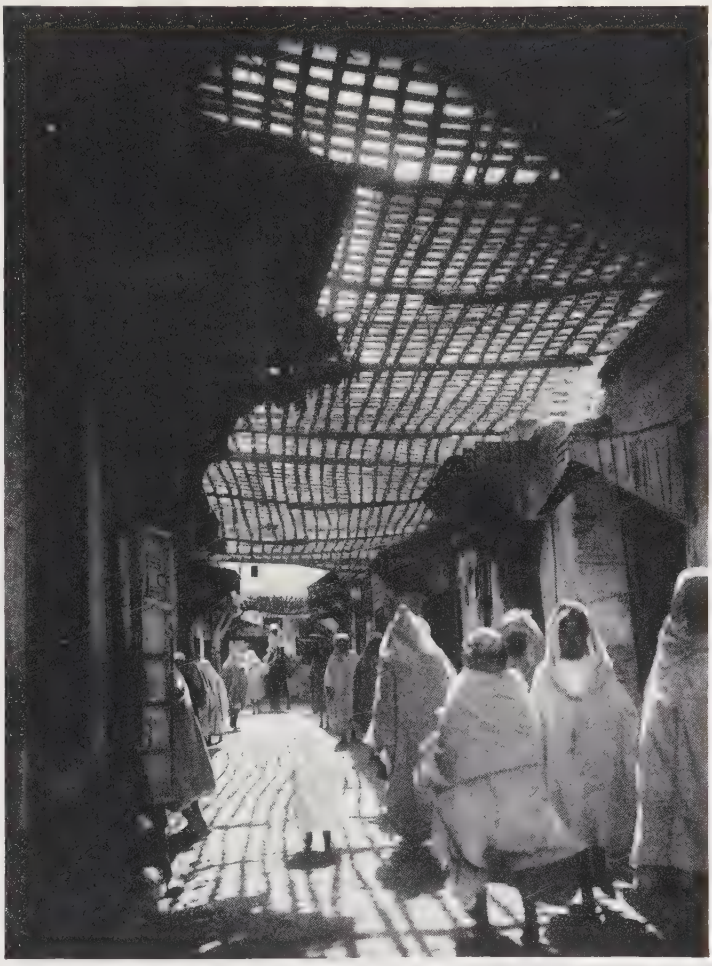
Here are the mosques and the *medersas*, or preparatory schools with dormitories for students, built over small mosques, higher Mohammedan education being received in the large, main mosque.

While travelers in Morocco may not

enter the mosques now open to them in Algeria, they may see in the medersas the beautiful Moslem architecture at its best. In Fez there are four of these old buildings dating from the fourteenth century, and a fifth, of a later period, which is also a jewel.

For nearly 1,200 years Moslem art, over a vast territory stretching from the Far East to Morocco and Moorish Spain, has been essentially the same—simple of outline, with decorations in complicated geometrical design, since the Moslem faith is prejudiced against the representation of any form of life.

All Moroccan mosques, medersas, homes, shops, and cemeteries look more or less alike, forming an incomparable setting for a people whose dress, regardless of station, is alike in form and coloring. It is, I think, this whiteness and sameness which give to the cities of Morocco, no matter how thronged their streets, an air of quietude.



Photograph from Joseph Bouhsira

A SHOPPING STREET IN THE HEART OF OLD FEZ

The roof, designed to minimize the severity of the sun's rays, is a lattice of reeds. The booths of the merchants are cubby-hole bazaars on each side of the narrow thoroughfare. On some of the streets of Fez horses and mules are allowed, on others only pedestrians. This is one of the former, as shown by the well-to-do individual in the distance, who is mounted.

Only the motion picture can bring before one the never-ceasing human tide which flows by day through the narrow, crowded streets of Fez. The Moors, who number, in the French and Spanish zones, about 6,000,000, are a mixed race with a Berber base. This base we shall find, if we dig deep enough, to be white, allied to a prehistoric race of southwestern Europe. There are many admixtures—Arab, Jewish, Turkish, European. And there is also Negro slave blood from the far south.

Some of the aristocratic types are striking—men of white skin and noble mien, whose flowing robes lend a certain grace and dignity.

We pass a rich man astride a white mule. His high Moorish saddle looks uncomfortable, but the bright-red saddlecloth and woven bridle are most pleasing to the eye.

Balek! Balek! ("Look out! Take care!") shouts the poor man on foot, as he beats his wretched little donkey into the thick of the crowd.

A MEDICAL MISSIONARY TALKING WITH A BOY OF FEZ

The European woman has conformed to the Moslem custom by wearing a white *djellaba*. The boy carries a bowl of couscous, a favorite food in Morocco (see also Color Plate I).

The upper-class women rarely venture out. Theirs is a walled life, illuminated by the joy of motherhood and the companionship of sisters in seclusion. The faces of the muffled women seen on the streets—servants, household slaves, wives of poor men—are veiled. Between bands of white, two dark eyes gleam out; or else the veil is so drawn that only one long-lashed eye remains uncovered. These women, barelegged like the men, shuffle along in heavy-soled, heelless slippers.

In marked contrast to the people seen in the Medina are those of the Mellah—sly, furtive old Jews in black gaberdines and skull caps, modern Jews in European clothes, fat old Jewesses wearing frayed Persian shawls, bright-faced, creamy-skinned young Jewesses with big, black eyes, their heads wrapped in gaudy silken scarfs. To these the coming of the French meant the end of long years of oppression.

To the Mellah the traveler goes for postcards and photographs, to have films developed, to look for the odds and ends needed in traveling. There are few curios to be found here save exquisite bits of filigree of ancient design in the dingy little shops of the goldsmiths.

THE HOME OF THE RED FELT FEZ

We must go back to the native town for the silk embroideries for which Fez is noted. Here, too, are manufactured saddlery and leather slippers, musical instruments, a crude painted pottery and glazed tiles like those the Moors gave to Spain. The French are reviving these native crafts, along with the matting of Salé, the rugs of Rabat and the Berber villages, and the brassware of Marrakesh (see Color Plates II, V, and VII).

Until recent times Fez had a monopoly on the red felt caps which bear the city's name. I was told that in the old days the carmine dye for these caps was obtained from the juice of a Moroccan berry. Nowadays fezzes are also manufactured in Turkey and in France.

To the royal palace the reigning sultan, Mulai Yusef, comes but seldom from his more modern abode, beside the home of

the French Resident-General in Rabat. Women of his harem live behind these moldering walls.

A NESTING LAND FOR STORKS

On all these massive Moroccan walls storks, in nesting time, hold sway. I saw their brushy nests, too, on the thatched peaked roofs of mud huts throughout the country, as many as fifty nests in a village of twenty huts. The natives love and cherish these big, friendly birds. The annual migration brings the storks north from South Africa to southern Europe in the early spring. Thousands fly no farther than Morocco. The young hatch earlier here than in Spain. In the meadows where cattle graze I saw many small white egrets, also migratory in North Africa. They follow the cattle, feeding upon insects disturbed by them, often perching on their backs.

In the French quarter of Fez one sees the attractive modern Franco-Moorish architecture which has reached its glory in Rabat, capital of the Protectorate, on the Atlantic coast. During the early years of French occupation structures in Casablanca, the first city built by the French, were on European lines, unsuited to the climate and a blot on the Moorish landscape. Since then a new architecture—beautiful, suitable, blending well with the pure Moslem—has been evolved.

The French in Morocco have had to build extensively—administrative buildings, post offices, barracks, railway stations, warehouses, hotels, shops, homes. A Fine Arts Commission supervises all buildings and grounds.

The buildings, always white, are usually of two stories, with walls of concrete or soft native limestone. There are broad windows instead of the blank Moslem walls. There are arcades, patios, col-

Photograph by Captain Paul Martel

A MARRIED WOMAN OF THE ARISTOCRACY OF FEZ

She wears a gold diadem and headpiece, precious stones and pearls. On the sides of the face are nets of fine pearls; on the breast are collars of pearls, with large emeralds. Her gold collar has pendants of precious stones; her silk belt is embroidered in gold, with a snap buckle of gold and precious stones, and the dress material is of cherry-colored silk worked and embroidered in gold. Both jewels and dress are sometimes rented or loaned by parents or friends. Their weight is so great that the bride can stand only a few minutes at a time and she cannot walk. The value of the ornaments and dress shown in this picture has been estimated at two million francs.

ELABORATE PLASTER ART WORK FOR THE SULTAN'S PALACE AT MARRAKESH

umns, and arches. Color is introduced in bands of glazed tiles, blue predominating. The effect is one of space, beauty, comfort.

Some day, when the newly planted semitropical gardens have growth and bloom, these artistic, yet substantial, buildings will form a pleasing background for a perfect riot of color.

To the student of Spain and Portugal and Latin America, Morocco is a golden link in history's chain. Constantly I was reminded of all that the Moors gave to the Iberian Peninsula in architecture, arts, language, customs, flora. I could not, on the other hand, trace much of Spanish or Portuguese influence back to Morocco, whence Moslems fled after each Christian victory. To Fez from Granada, after the final expulsion of the Moors, came Boabdil, last of the Moorish rulers of Spain, to live on for more than 30 years.

FINER RAILWAY COACHES THAN ANY SEEN IN EUROPE

From Fez the trail reaches Mekinez in two hours by perfect motor highway or by broad-gauge railway, with finer coaches than any I saw in Europe.

It is the situation of Mekinez that places it among the unique cities of the world. We arrived after nightfall and drove what seemed to be an interminable distance to the hotel, which was, the coach driver explained, on the edge of the French settlement overlooking the native city. At last he rang the bell at the hotel

Photograph by Captain Paul Martel

AFTERNOON TEA IN A MOSLEM CEMETERY OUTSIDE THE WALLS OF FEZ

Friday is the day given over to Moslem women in the cemeteries of Morocco, and no man is supposed to enter the inclosure until late in the afternoon, after the ladies have departed. The women bring flowers and food to place on the graves and they make a sort of picnic holiday of the occasion, which varies the monotony of their shut-in lives.

gate and two Moorish house-boys wearing baggy, white knee breeches, green silk sleeveless jackets over white shirts, white aprons, and the customary red fezzes, came down, with a pleasant French greeting, to receive us.

When we looked from the window next morning, all Mekinez lay below us across a deep canyon—an oblong white city within its surrounding walls. The sunlight sparkled on the bluish-green tiled domes of the mosques. I counted 15 minarets.

Beyond the white town we saw the Cyclopean red walls of an older city stretching for miles across the flower-spangled plain, the city built by the arrogant Sultan, Mulai Ismail, who died in the early years of the eighteenth century, after a reign of 55 years, father, we are told, of more than 800 children.

HORSES THAT CARRY THEIR MASTERS 100 MILES A DAY

Hearing of Versailles and the pomp of Louis XIV's court, Mulai Ismail tried to rival it. Thousands of Christian slaves toiled on walls and palaces. The royal stables are said to have held 12,000 horses.

The French are now using these long-abandoned inclosures for practical purposes. There is a museum in the Sultan's palace. The old gardens bloom again. At the stock farm we saw spirited cream-white Arab horses, associated in Western minds with the Moors, who gave this noble strain to Spain.

"Wonderful horses throughout the country," a French enthusiast told me. "From here the Romans recruited their famous cavalry. Across the Atlas there's a breed, known as 'wind drinkers,' that hunt the ostrich and carry their masters 100 miles in a day."

Within the inclosure of the French hotel grounds at Mekinez is a small white-domed building, the shrine of some dead saint. Here an old *Marabout* (holy man) lives. I saw an old woman climb up the steep path from the highway to sweep out his shrine, and an aged man bring him food. Such shrines and such

BRINGING A WESTERN SEWING MACHINE TO THE HAREM: CASABLANCA

Casablanca, having more European residents than any other city in Morocco and being the first to receive Western innovations, is the one where the sewing machine more easily finds a place in a Moslem home. The men are the tailors here rather than the women. The woman carrying the machine is a servant.

Photograph by Harriet Chalmers Adams

A SOFT-DRINKS AND LUNCH COUNTER AT A WAY STATION ON THE MEKINEZ-RABAT RAILWAY

There are first-, second-, and third-class accommodations on this line, and, as the natives love to ride, the third-class coaches are always crowded. This vender has discarded native dress for European clothes, except for the turban. He had been a soldier during the World War and asked the author about a number of French towns with which he was familiar.

holy men are to be seen throughout Morocco.

The Moors are very fond of using nicknames, not only among themselves, but especially when speaking of Europeans, whose names are unpronounceable and difficult to translate into Arabic characters. These nicknames are usually based upon some physical peculiarity; hence, "Lord Deaf Man" and "Lord Lame Man." A British resident in Morocco, whose wife addressed him in terms of endearment, was always called "Mr. Dearie" by the native cook.

I remember Mekinez at sunset—a narrow white town backed by those flamingo-fringed clouds which are the glory of this country; again, of almost supernatural beauty, under the glowing stars.

ROMAN RUINS BEING UNEARTHED

Not far away, among the silent Zerhoun hills, are the ruins of Roman Volubilis, where French archeologists are piecing together fragments of stories in stone. While not as imposing as the Roman ruins of eastern Algeria or Tunisia, Volubilis and other sites nearer the Atlantic speak of those days when Mauritania was more than a name on the map.

There is a forest of cedars and oaks east of Mekinez and a forest of cork oaks between that city and the coast. These and the argan forest back of Mogador are the only trees on the wide Moroccan plain tilting upward from the Atlantic to the Atlas Mountains. The people call this unforested section the Bled (see also text, page 287). In spring great stretches of purple iris and countless marsh-loving birds beautify it, but to the men who cross it with their swaying camels and pattering donkeys, under the burning African summer sun, it must seem a dreary waste.

The French are reforesting the hills, taming the rivers, and building irrigation ditches, as in Algeria. Pine logs cut in the Atlas are floated downstream to the sea.

The cork oaks of Morocco, ruthlessly destroyed in the past, are like those in the Iberian Peninsula. Last autumn the United States made its first direct purchase of Moroccan cork. The argan tree is in a class by itself—gnarled, twisted, limited in habitat, a survivor of an age before the desiccation of the Sahara. It looks a little like the acacia and produces a nut about the size of an olive, from which oil, used by the natives in cooking, is extracted.

From Mekinez and its neighboring villages we went on to Rabat. This was not my first visit to Moroccan coast towns, and I found many changes after an absence of 12 years. The twin cities of Rabat and Salé are separated by the wide Bu Regreg River, "Father of Glittering" (see also page 287 and illustration, page 300). The one, with its great citadel mounted proudly on the cliff where the river meets the sea, now merges into the progressive French capital. The other, quiet and white as a snowdrift, beside the restless gray ocean, is little changed since those adventurous days when it harbored the fierce Barbary pirates known to Britons as the "Sally Rovers," who plundered the coasts of southern Europe, sailing as far north as the British Isles.

Many an unfortunate Christian captive came in chains to Rabat and Salé over the foaming river bar.

This inhospitable West Coast is without natural harbors, and the French have spent a small fortune on the port of Casablanca, an hour's ride south from Rabat. This city, the second in size in the country and the home of most of the European residents, is the economic center, just as Rabat is the administrative base.

It was here, in 1907, under a dying dynasty, that the French occupation of Morocco really began. It was not until 1912, after native soldiers had massacred their French officers in Fez, that Marshal (then General) Lyautey was appointed Resident-General. Marching to Fez, which was besieged by 20,000 Berbers, he and General Gouraud drove away the rebels. That Morocco was held and pacified during and in spite of the World War is one of the greatest of military achievements.

FROM SOUTH OF CASABLANCA COME THE VAUDEVILLE ACROBATS

South of Casablanca, by sea boulevard, lie Mazagan and Safi, rich in Portuguese associations, with crumbling fortresses built 400 years ago, when Portugal was the greatest maritime nation in the world, with trading posts far down the West African coast.

Photograph from Willard Price

A WATER VENDER OF MEKINEZ

As he makes his way through the crowded streets ringing his bell, the merchants, who cannot leave their wares to go to the drinking fountain, buy his none-too-clean water from the goatskin bag on his back.

The ghosts of gallant *fidalgos* seem to haunt these noble old battlements.

Mogador, south of Safi, is the gate of Marrakesh, the largest city of Morocco, now reached by rail and highway—beautiful palm-fringed, red-walled old Marrakesh at the foot of the High Atlas, more African in character than any of the other cities I have named. To it come jaded camel caravans from the Sahara, and strange, untamed men from the Dráa, the Ziz, the Gir, and the Sus, those little-known fertile valleys on the other side of the mountains.

From the Sus come the acrobats famous on the international vaudeville stage. The French have built motor roads over the Atlas. Even Veiled Tarudant, in the valley of the Sus, will soon be accessible to the traveler.

Barley, wheat, beans, camels' hair, hides, skins, almonds, and beeswax are some of the products brought out by camel caravan and donkey train from inland Morocco. There are 100,000 camels in the country.

Cattle are shipped in great numbers to Portugal; sheep to Spanish Morocco, Spain, Algeria, and France. Both mutton and wool are becoming short in France.

Moroccan hens must be very industrious, for incredible numbers of eggs are annually exported. One of the chief imports is tea, the national Moroccan beverage, served very hot, very sweet, and flavored with mint.

"I want to cross them mountains," a queer American tourist coming out of Marrakesh said to me, "and see the tents of the *A*-rabs!" When he goes I hope he will not flounder as hopelessly in Saharan sands as he has in the Moroccan racial maze.

Profiting by their own mistakes in Algeria and Tunisia, the French in Morocco have made a steady advance in pacification, unification, and progress. Abreast with the troops, in greater part native, but officered by Frenchmen, have marched the roads, railroads, schools, hospitals, and agricultural bureaus.

Young Moorish aristocrats are being educated, on Mohammedan lines, to serve as future military officers and municipal executives. Young Moorish women of

IN THE POTTERY BAZAAR: TANGIER

There is a great square or market place in this city where the country people gather, arriving on foot or on donkeys. With their laden camels and donkeys, they bring all sorts of produce and wares, and each article has a special place or corner in the market.

Photographs by H. F. Wight

THE GRAPE MARKET OF TANGIER

This fruit comes from Cádiz Province, Spain. There is a daily round-trip service between Tangier and Algeciras, leaving Spain in the morning and returning at night.

Photograph by H. F. Wight

ENTERING ONE OF THE GATES IN THE OLD WALLS OF TANGIER

In Tangier one sees a far more cosmopolitan crowd on the streets than in any other Moroccan city, and many more tourists, as so many Mediterranean-cruise ships touch here, and it is only a few hours from Gibraltar by one line and from Algeciras, Spain, by another.

the leading families are being trained. There are schools for French and native children in all the towns, and the long-established Hebrew schools continue.

"It isn't in the fine, large hospitals, where there are separate wards for Christians, Moslems, and Jews, that the best work is being done," the wife of a French officer in Fez told me. "There is a hospital here just for poor Mussulmans, reached through a gate in the outer wall.

"The surgeon is the only 'infidel' in it. His helpers are natives. The most fanatical of the people, who will not let us enter their homes or help them in any way, carry their sick to this hospital. To them the doctor is almost divine."

In this grain-producing country, only 500,000 of the 5,500,000 inhabitants live in the cities. The Berbers are born farmers.

Sugar cane and rice will grow in this land of the olive and the vine, the orange and the fig, and cotton has already been planted along the shores of the Sebu River.

The French claim that certain sheltered valleys of southwestern Morocco are as well suited as the Canary Islands for the growing of bananas, and there are potential forest areas and minerals unexploited. Already a rich phosphate deposit back of Casablanca is being worked.

A MOTOR JOURNEY FROM CASABLANCA TO TANGIER

It is a long day's motor journey from Casablanca to Tangier. The Tangier-Fez Railway should be in operation before many years. A year ago the roadbed was graded nearly all the way from the Fez-Rabat line north to the Spanish border. The highway, which crosses first a low plain and then a hilly country before again skirting the sea, parallels this future railroad.

We passed through Kenitra, a new French town at the mouth of the Sebu River.

At Souk-el-Arba we saw a country market in progress. "Souk" is "Market" and "Arba" is "Wednesday." All country

Wide World Photograph

TYPES OF RIFFIAN WARRIORS WHO HAVE BEEN THORNS IN THE SIDE OF SPAIN-IN-MOROCCO FOR YEARS

These tribesmen, numbering about 30,000, led by the chieftain Abd-el-Krim, occupy the hill territory of the Spanish Zone, a region about 200 miles long and 60 miles deep, overlooking the Mediterranean Sea. They are of Berber stock, allied to other indigenous mountain tribes of North Africa.

markets in Morocco bear the name of the day on which they are held. The people come from long distances with their produce. There is, I believe, no Saturday market because the Jews, who are the chief traders, will not attend.

Arbawa (Arbaoua) was our last French village. Here customs officials examined our luggage. Again we were straying from the tourist circuit. Our companions were French Colonials and Tangier Moors, who could be questioned about the country we were crossing.

The officials at the Spanish frontier were trim and businesslike. We had been warned that we should run right into the Spanish-Moroccan war zone and be shot by the Riffians, but we saw only Spanish soldiers repairing roads and working on the walls of forts.

Many military convoys passed us bound from Larache to the outposts, nearer the Riff Range. We saw, in fact, the beginning of the work of pulling in jagged outer lines and the strengthening of forts on a new Spanish front.

Alcazar (El Ksar-el-Kébir) was our first Spanish-Moroccan town. It is a historic spot. From here expeditions set out for the conquest of Spain. Here, in 1578, Dom Sebastian and the flower of Portugal fell in a mighty battle with the Moslems, a black day for the gallant little land of Prince Henry the Navigator.

Now we headed for the sea, for Larache and Arzila, the two old Portuguese *presidios* on the Atlantic shore of the Spanish Zone. At Larache we crossed the wide Loukkos River on a pontoon bridge, and beyond Arzila came to a stretch of salt marsh where the highway serves as a bridge.

"There's Cape Spartel!" the man next to me cried.

We were rounding the northwest corner of Africa. We were in the International Zone. Ahead lay Tangier.

This city, so well known to travelers,

Wide World Photograph

SHARPSHOOTERS IN THE RIFFIAN HILLS

Recently the Spanish military directorate inaugurated a new policy of withdrawal of Spanish troops from the interior to a fortified coastal belt. The Riffian tribesmen are valiant fighters, but the smallness of their numbers and the fact that they are like an island in the ocean, now completely surrounded by a pacified zone, either French or Spanish, seem to point to their ultimate subjugation, the fate that has overtaken equally brave aboriginal tribes blocking Civilization's path throughout the world.

has great possibilities and may some day be made as attractive as Algiers. The long-discussed and much-needed port works will soon be under way. Tangier has motor-bus service with Arzila and Larache and with the inland town of Tetuán, the Spanish administrative base. A railway connects Tetuán with Ceuta, just across from Gibraltar (see page 298). Ceuta and Melilla are Spain's sister fortresses on the Mediterranean under the shadow of the Riffian Hills.

In the United States there is much misinformation current regarding Spanish Morocco, the general impression being that every Moor is about to cut the throat of every Spaniard. The truth is that a fair percentage of the 500,000 native inhabitants speak Spanish and, through centuries of association, are on friendly terms with their conquerors. There are many Spaniards living among the Moors and loyal Moorish soldiers fighting with the Spaniards against the Riffians.

The Riffian clansmen, with whom Spain is having such great difficulty, are Berbers, allied in blood and independence of spirit with other hill tribes of North Africa. They occupy a semicircular mountainous district back from the coast, extending from southeast of Tetuán to east of Melilla. Some of the peaks of this region are nearly 6,000 feet in height.

In their mountain fastnesses, with their herds and flocks, upland forests and little vales between the hills, where grain can be grown, they are self-supporting.

The coastal fields of Spanish Morocco are peacefully cultivated. Seeds and agricultural implements are being distributed among native farmers, roads are being built, schools are being opened.

In safety and comparative comfort we journeyed across Old Morocco, seeing, as through the veil of centuries, country life as it was three thousand years ago, cities which are perfect settings for Arabian Nights' tales, oases where clustering date palms whisper the secrets of that vast Sahara which lies beyond.

THE SINGING TOWERS OF HOLLAND AND BELGIUM

By William Gorham Rice

THE story I shall tell here is one of exploration, not in distant lands, but in the near-by and well-known Low Countries. It is a tale, too, of discovery for most Americans, at least, of a new kind of music.

That this rather unusual subject may be the more readily understood, it is worth while at the beginning to give a few moments' thought to the lands where this unique music originated, and to consider why it is now attracting special interest.

Four hundred years ago Charles V, Roman Emperor and (as Charles I) King of Spain, inherited the territory now within the boundaries of Holland and Belgium.

To duchies, counties, bishoprics, and lordships existing there, he added French Flanders, and proclaimed a new political unit under the name of the Seventeen United Provinces. Appropriately, the seal of the new federation was a lion holding a sheaf of seventeen arrows.

But soon the sheaf fell apart and the arrows were turned against one another in long and devastating war.

Yet within this distracted territory, and in a time of sieges and of distress unparalleled, a civic music of rare beauty came into being—a music which, while continuing ever since and increasingly holding a place in the love of its people, has been until lately almost unknown outside the boundaries of its origin.

Gradually since the time when Charles V reigned, this music has been wonderfully developed. To-day it is widely commanding artistic consideration and, with its noble architectural setting, it is coming to be recognized as peculiarly fitted to adorn and stimulate civic and community life everywhere.

A LAND DOTTED WITH SPIRES

The region of which this article treats extends from the North Sea shores inward for 50 miles or more in plains which are largely just above high tide. Often, with protecting dikes, portions of fertile acreage there are found even below sea level. Throughout these tranquil reaches windmills and waterways abound, and sometimes ships seem to be sailing through the land.

On every side one sees scores of cities, towns, and villages. In the foreground these are clearly defined, but in the middle distance they become less distinct, and on the horizon in soft and misty outline they almost disappear.

In every such extended view, above town hall and city gate and ancient church, rises dominant here a rugged tower, there a tall belfry or a graceful, slender spire. And each of these skyward-soaring structures becomes for the traveler a Singing Tower if, on nearer approach, he finds it crowned with that majestic instrument of music called a carillon.

The word "carillon"—pronounced "car' i-lon," with the "o" as in "atom"—and the derivative, "carillonneur," are French in origin, but now generally accepted in English.

THE CARILLON EXPRESSES THE SPIRIT OF A COUNTRY

After crossing the Atlantic, we touched at Plymouth and at Boulogne, and then on a Friday night came in sight of the shores of the Netherlands. At the mouth of the River Maas (Meuse) we waited for the high tide at two in the morning, to make it possible for our great ship to steam slowly up to Rotterdam.

Here we found the tower of St. Lawrence's Church, whose old bells make not merely a great musical instrument, but by their melodies express the spirit of the country over which they sound.

De Amicis, the Italian traveler, after climbing the tower of St. Lawrence, said that the indefinable sentiments inspired by the Dutch landscape held him silent for a long time. Then he was startled by strange music coming from he knew not where—the silvery notes now falling slowly one by one, now coming in groups,

Photograph from William Gorham Rice

THE SINGING TOWER OF THE NEW CITY HALL AT ROTTERDAM

Its carillon of 47 bells, the largest and finest installed in the last 100 years, is the gift of Phs. van Ommeren, Jr., shipping merchant of Rotterdam and New York, and commemorates a family name long identified with Dutch commerce. Rotterdam boasts two other carillons—that of St. Lawrence's Church (see opposite page) and that in the tower rising above the Bourse.

in trills, in sonorous chords, a quaint dancing strain somewhat primitive, an echo of the ancient life of her people, making one smile and sigh at the same moment.

We mounted the circular stone stairway leading to the heights of tower after tower to see the bells of a carillon in all their beauty of decoration and arrangement.

We found ourselves among a great company of bells, fixed upon a heavy framework and extending in parallel rows, tier above tier, completely filling the great tower room.

The little bells hang in the highest tier; the big bells just clear the floor; the intermediate sizes hang in tiers between. The largest bell of all is taller than a tall man and it may weigh four, five, or even six or eight tons. The smallest bell has a height of 10 or 12 inches only and perhaps a weight of less than 20 pounds.

Photograph from William Gorham Rice

THE SINGING TOWER OF ST. LAWRENCE'S CHURCH, ROTTERDAM

In this tower is a carillon of 39 bells, most of which were made in 1660 by Frans Hemony.

Soon our search showed us that of greater consequence, however, than number, or size, or weight, is the pitch relationship of the bells; for the bells of a carillon always progress by regular semitone or chromatic intervals. The carillon of St. Lawrence's tower has these intervals complete through more than three octaves, except that the two lowest semitones are lacking.

CARILLONS ARE PLAYED BY TOWER CLOCKS AND BY HAND

The arrangement and character of the bells had first attracted our attention. Then we began to study how the music is produced. We soon discovered that a carillon is played in two ways:

First, automatically by a revolving barrel connected with a tower clock, which starts the music at the hour, the half hour, and at the quarters, and sometimes even at the eighths (see page 364).

Second, by a trained musician, a carillonneur, seated at a keyboard like that of an organ. Six and even more notes can be struck in chords on the carillon keyboard, and, so delicate are the adjustments, that sustaining tones on the lighter bells are easily accomplished by "tremolando" (see page 367).

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THE ONCE FLOURISHING PORT OF VEERE: THE NETHERLANDS

The town is full of architectural relics of its palmy days of the 16th century, when it was the chief continental trading port of the Scottish woolen factories. Its ancient houses and historic town hall, with its graceful singing tower, form a real picture. Its carillon has 34 bells, chiefly from the foundry of Pieter and Andreas van den Gheyn, of Amsterdam.

Automatic playing of simple folk songs, chiefly on the light bells, with now and then the addition of a deep bass tone, is what the traveler constantly hears as he wanders through old towns in Belgium and Holland. The keyboard-playing by a carillonneur is reserved for special occasions only. It takes place on the market day, and on Sunday, and in the greater cities on a fixed evening every week in summer, particularly in Belgium. Then for one hour an elaborate concert, often with a printed program, is given. Then, too, the best music of great composers, such as Beethoven and Schubert, is played, as well as beautifully arranged Flemish and French folk songs and national hymns.

Thousands gather for these concerts. Quiet, even in so large a city as Antwerp, is then maintained in the neighborhood of the tower, vehicle traffic being diverted

Photograph from William Gorham Rice

LEIDEN TOWN HALL, WITH THE CARILLON TOWER IN THE BACKGROUND

After mounting the fine perron leading to the main entrance and reaching the burgomaster's room, which is adorned with magnificent old tapestries, it is a short climb up an electrically lighted stairway to the carillonneur's room. The ceiling of his room has mortised beams radiating from the center and has white stars painted on a blue ground in the spaces between.

from the near-by streets by order of the burgomaster.

ROTTERDAM HAS VARIETY OF CARILLON STRUCTURES

The tower of St. Lawrence's Church was begun in 1449, and the city placed a carillon in it in 1660. In the tower of the Rotterdam Bourse we found a smaller carillon of 27 bells, also more than two and a half centuries old.

A third carillon in Rotterdam to which we listened is the one that has just been placed in the new City Hall. It is larger, both in weight and in number of bells, than any carillon made in the last 100 years (see illustration, page 358).

Rotterdam's three Singing Towers, rising one above the City Hall, one above the Bourse, and one above the Church of St. Lawrence, gave us a clue to the variety of structures which may possess

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A HESITATING PURCHASER: ARNEMUIDEN FISHWIVES IN THE MARKET OF MIDDELBURG

a carillon. Our journeys showed us that similar music had floated for more than two centuries over the city gate at Enkhuizen, the Royal Palace at Amsterdam, the Weigh House at Alkmaar, the Cloth Hall at Ypres (destroyed during the World War), the University Library at Ghent, the Wine House at Zutphen (burned in 1921), and the Abbey at Middelburg, and that the spires of not a few of the historic churches of the Low Countries are Singing Towers.

Finally, we discovered the important fact that wherever a carillon hangs, its bells are owned by the city, its carillonneur is an official chosen by city authority, and the tower itself is under city control.

What a ride of peaceful beauty it is from Rotterdam to The Hague! Windmills and waterways, long rows of slender trees, and black-and-white cattle contentedly grazing, are to be seen on every side. We went by automobile in order to enjoy with fresh appreciation our first 14 miles in Holland.

At Delft the carillon is in the spire of the New Church, called "new," though over 400 years old, because it was begun

© Donald McLeish

ZEELAND VILLAGERS AT A CHURCH SERVICE

The costume and headdress of the women of this district are among the most elaborate in Holland.

a century later than the Old Church, near by. Here, far above us, we could see nearly four octaves of bells, ranged in rows above and on both sides of the dial of the tower clock.

Within the New Church, not far from the tombs of William the Silent and of Grotius, we found the final resting place of Delft's most famous carillonneur. On it is this inscription:

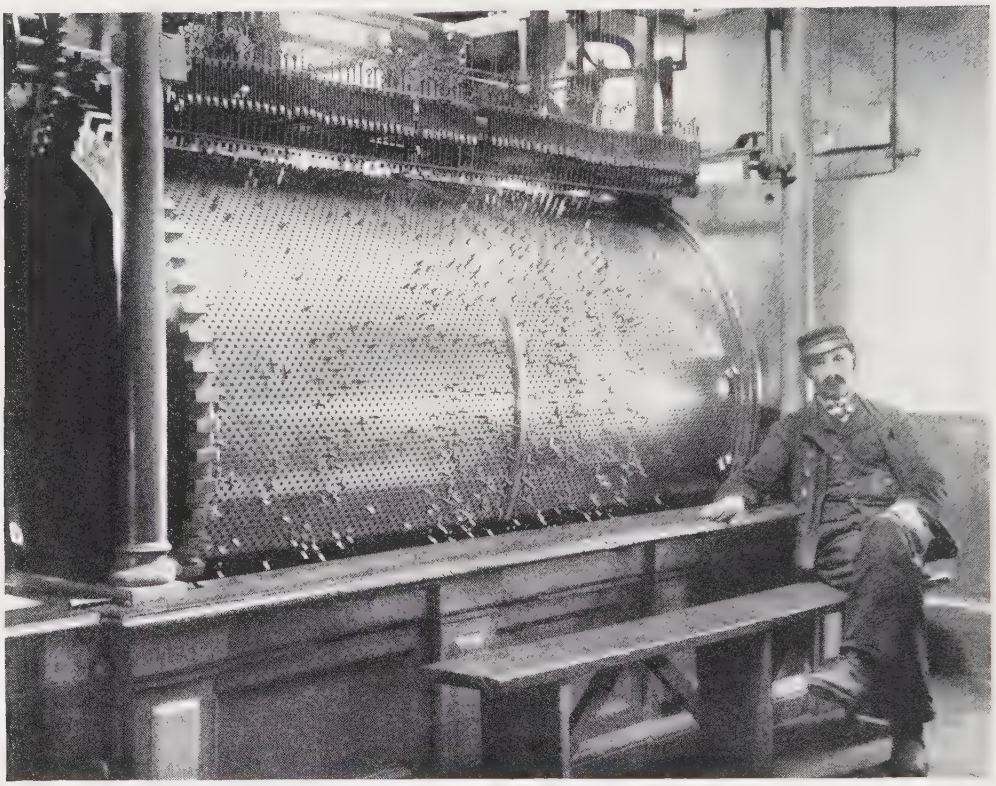
> Here lies Dirck Scholl, who for more than sixty years made the carillon in the New Church to live.

Six miles beyond historic Delft lies The Hague—old, yet cosmopolitan, and ever delightful. We walked across the Square to the near-by Vyver, that small sheet of water in the center of the city, surrounded by shaded walks and the restful Parliament buildings.

As we sat under the trees looking down on the fascinating reflections, we heard coming faintly from the Singing Tower in the background an enchanting folk song. Then slowly a deep bass bell gave the afternoon hour.

HOW THE CARILLON ORIGINATED

In Holland and Belgium, about the middle of the 15th century, when timepieces were rare, and the people were much more dependent upon the town clock for knowledge of the time of day



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THE CHIME MECHANISM IN THE LOFTY TOWER OF "LONG JOHN" OF MIDDELBURG

The large metal drum rotates once every hour. The teeth on the drum, set at proper intervals and striking the keys, which are connected by wires with the 40 bells of the tower, play various popular airs. From time to time the pins are changed, as different tunes are desired. The mechanism bears the date 1715.

or night, it became the custom, as a premonitory signal, to precede the striking of the hour by a short automatic chiming on three or four small bells hung in the clock tower.

As this town and that sought to surpass its neighbors the bells were increased in number and the musical scale of tones and halftones thus became complete. Brief melodies began to be heard at the hour and the half hour, and with the addition of still more bells came, at these divisions, whole tunes played upon three or even four octaves of bells. All this playing was automatic.

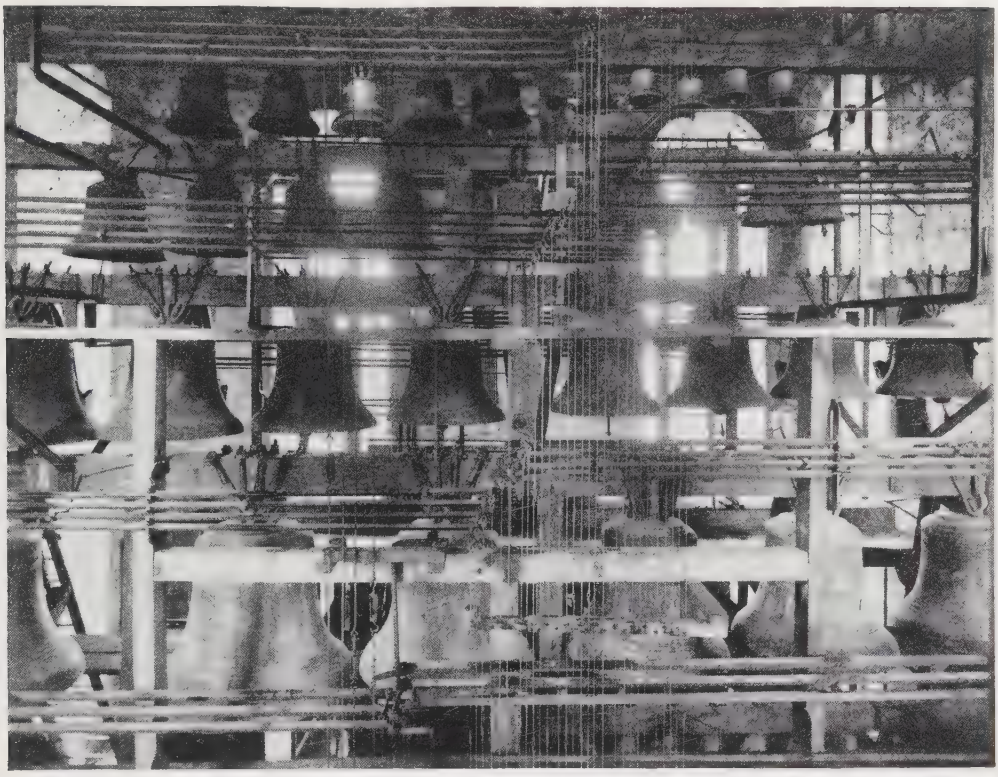
Then came the adoption of the keyboard, similar to that of the organ, with each key representing a bell note and readily responding to the art of the accomplished musician. Soon pedals were devised to play the heavier bells.

Thus, in the course of two or three centuries, was developed the carillon.

By making The Hague a center we found we could easily reach every part of Holland's carillon region in day journeys. Early one morning we went to Gouda. There, in the great church, we gazed upon the wonderful 16th century glass windows, the finest in Holland, abounding in glorious color, allegorical design, and historic interest, and listened as the carillon played far above us.

A CARILLONNEUR MUST BE FREE FROM GOUT

Ascending the steep winding staircase, we came finally to the carillonneur's cabin. There a charming scene met our eyes. Seated at the keyboard was the carillonneur, surrounded by an admiring group of seven boys and girls, who were thus



Photograph from William Gorham Rice

THE BELL CHAMBER AT GHENT, BELGIUM

The massive masonry and the tall windows of the Singing Tower are seen, and rising tier above tier are many of the bells of the carillon, the smallest at the top weighing only about 18 pounds. The wires and rods connecting both the keyboard and the barrel (see page 364) with the bells show clearly. Here one feels he stands in the center of the most gigantic of musical instruments. Of the 52 bells at Ghent, 33 of the medium-sized and smallest are visible in the picture. Fine craftsmanship is displayed in the ornamentation of these ancient bells, which, hidden as they are in the high recesses of this Singing Tower, few eyes ever have opportunity to look upon.

enjoying the morning of their Saturday holiday. One boy played now and then in duet with the carillonneur, and later, in our honor, they played together, "My Country, 'Tis of Thee."

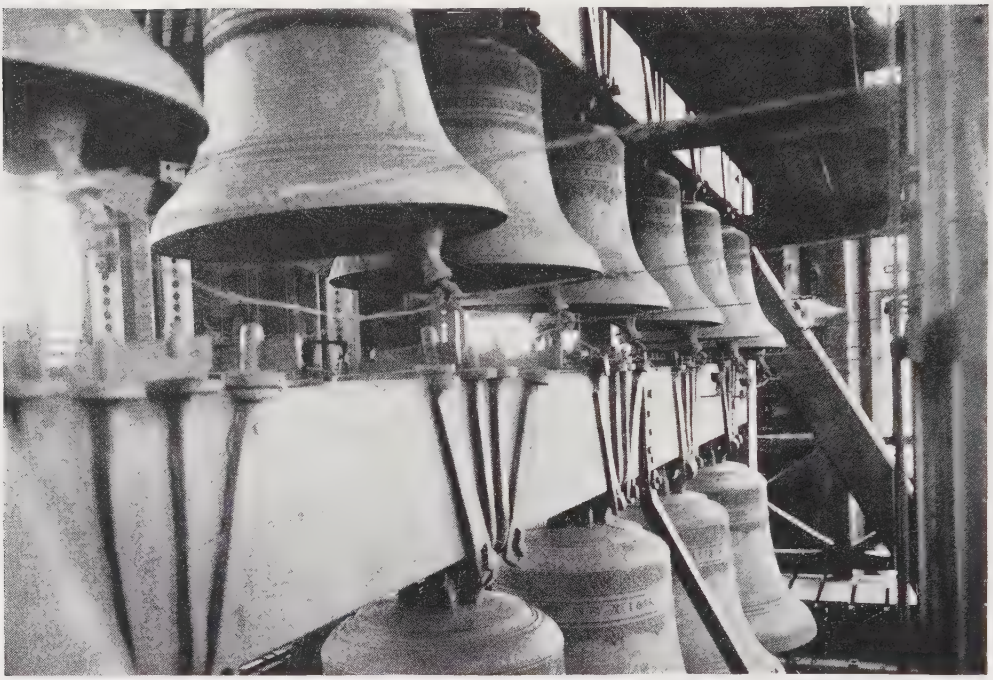
Painted on two of the great posts of the frame that carries the bells, we read the names and date of service of all Gouda's carillonneurs, from 1669 onward, covering two and a half centuries. The longest recorded term was 63 years, the shortest 10, and in all only seven names appeared. The present incumbent has already 16 years to his credit. He is one of the best carillonneurs in Holland and is deeply devoted to every phase of his art. Carillon playing everywhere in the Low Countries is a question not so much of pay as of pride.

Fischer, author-carillonneur, who played in 1738 in Utrecht, declared that a carillonneur must have a good knowledge of music, good hands and good feet, and no gout!

THE PILGRIMS HEARD LEIDEN'S CARILLON

Only half an hour from The Hague is Leiden, where we found the Singing Tower crowning the low and very beautiful Town Hall. The Pilgrims, who, after leaving England, lived for a time at Leiden, undoubtedly heard this music, for the city has had a carillon since 1578.

Twenty-five miles beyond Leiden we came to Haarlem. There the carillon is in the tower of the old church, famous for its organ and models of historic ships suspended high in the groined arches of



Photograph from William Gorham Rice

BELLS AND TONGUES IN KEYBOARD RECITAL AND CONCERT PLAYING

Tier above tier of bells in rows is seen in the carillon chamber. The tongues of the bells as used in keyboard play clearly show here. These tongues are held near to, but not touching, the inner sound bow of the bells, and are made to strike by a carillonneur seated at a keyboard like that of an organ. This keyboard has all the notes, like the black and white of the organ keyboard, through several octaves. The carillonneur in playing uses both hands and feet. He obtains a sustained note by tremolando; for, as the tongue of the bell is kept by springs close to the sound bow, a quick touch upon the delicately adjusted key of the keyboard sounds the bell successively, as often as may be desired.

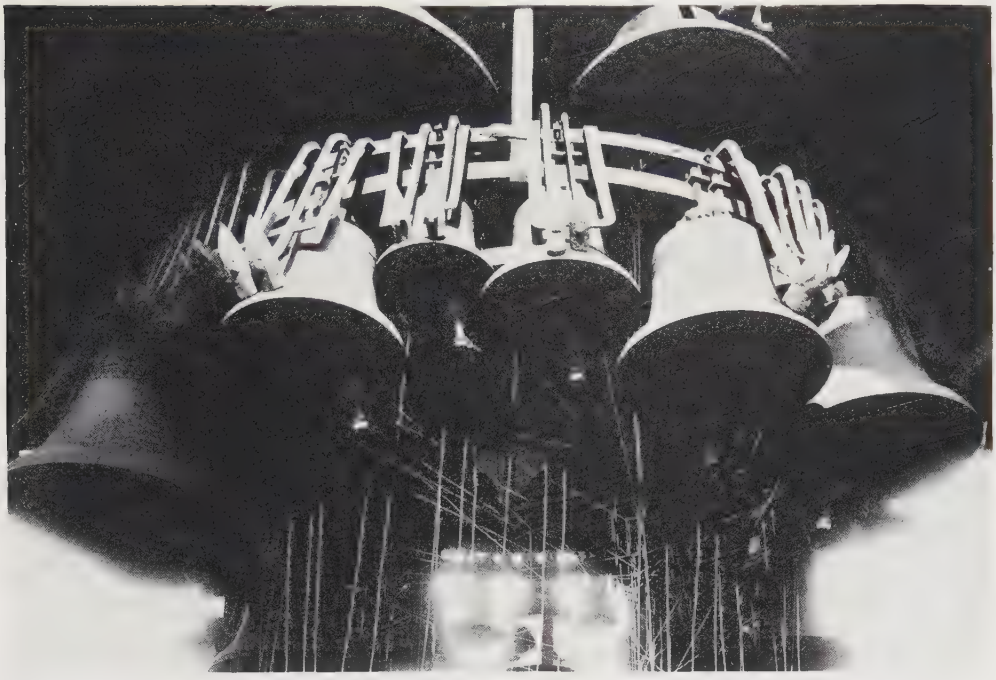
the ceiling. As we stood in a quiet street listening to the bells, a baker's boy passed us with a tray of cakes balanced on his head. He looked up affectionately at the tower, paused long enough to catch the air the carillonneur was playing, then joyously whistling it, he went the happier on his way.

AMSTERDAM HAS SIX SINGING TOWERS

Amsterdam, the commercial capital of Holland, lies 38 miles from The Hague. Whether the journey between these cities is made by railway, by canal, by automobile, by bicycle, or on foot, it is a succession of attractive scenes. To us it was a continuation of the beauty that we had already enjoyed between Rotterdam and The Hague, with the addition of tulip and hyacinth and gladiolus fields and in the distance, the dunes.

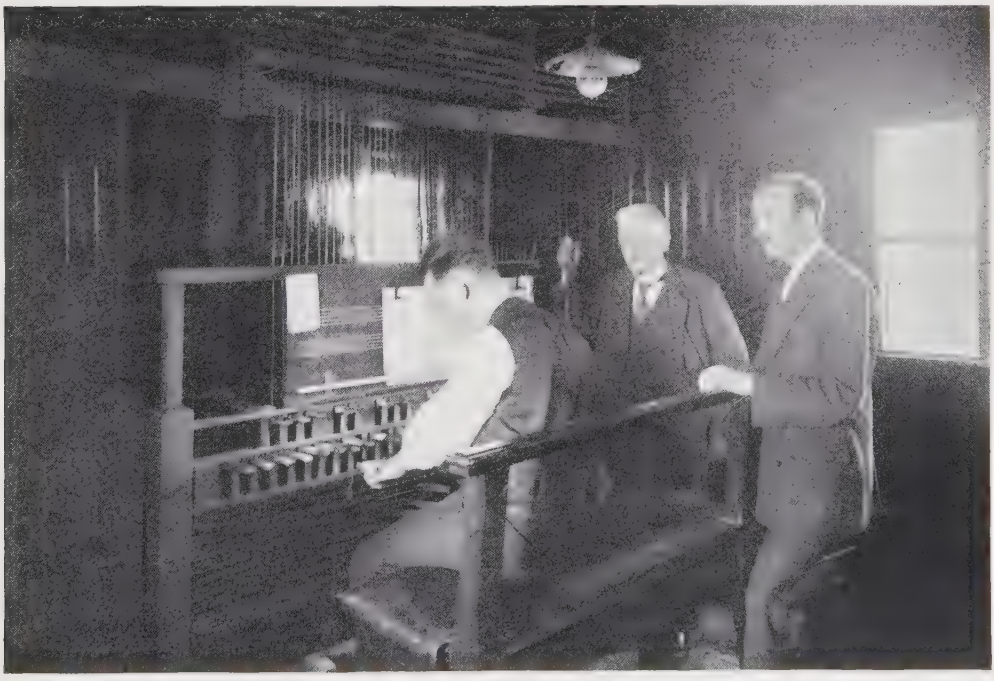
Amsterdam is first among present-day cities in the number of Singing Towers it possesses. The Royal Palace, the old Mint Tower, the Ryks Museum, and the Zuider, the West, and the Old Church spires all have carillons.

When we came to know that Amsterdam had six carillons we were not surprised that John V of Portugal, traveling in the Netherlands in 1730, was so impressed with this music that he determined to have a carillon for his sumptuous palace then being built. The price having been ascertained, it was guardedly suggested by his treasurer that the cost was rather great. This implied criticism so offended the self-esteem of the monarch that he replied, "I did not think it would be so cheap; I wish two." And these he got, for two magnificent carillons, played by keyboard and clockwork, exist to-day in the royal residence at Mafra, near Lisbon.



Photograph by D. J. Van der Vens

THE "GRAPE-CLUSTER" ARRANGEMENT OF HEMONY BELLS IN THE CUPOLA OF THE AMSTERDAM ROYAL PALACE



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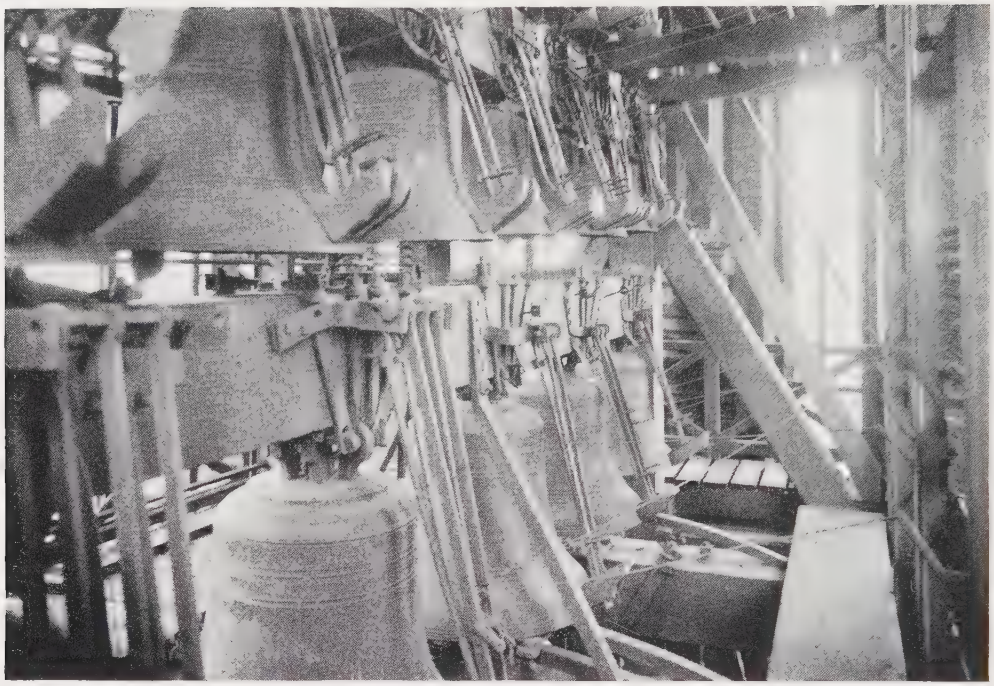
A CARILLON LESSON GIVEN BY JOSEF DENYN, GREATEST LIVING CARILLONNEUR

At the left (seated) is Nees, at the right Lefevre, two of his most promising pupils. The School of Carillon Instruction, free to the world, was inaugurated in August, 1922, at Malines (Mechlin), Belgium (see text page 376).



Photograph from William Gorham Rice

BELLS AND HAMMERS IN AUTOMATIC PLAY: ANTWERP

From two to five or six hammers are used on each bell for the automatic play. These hammers are connected with the great barrel, which is stopped and started by the clock mechanism (see page 364). More than one hammer is used, so that a quick repetition of a note may occur where needed in the melody. The hammers are connected by wires and rods with the levers, which are tripped by the arranged pins on the barrel. There are springs behind each hammer, which hold it when at rest a quarter to a half inch from the outside sound bow of the bell. This secures a clear staccato stroke each time the hammer falls. The tongues, which are used in keyboard play, also are seen about opposite the hammers (see also illustration, page 366).

Only copper and block tin, in the proportion of three parts of copper to one of tin, were used in making ancient bells, and the same practice prevails among the best bell founders to-day. From which it may well be concluded that the "golden molten" bells of Poe, the "heart-of-iron" bells of Longfellow, and the "silvery" bells of other writers are solely poetic license.

1,500 TUNING FORKS BRING BELLS INTO ACCURATE TUNE

In one foreign bell foundry the equipment consists in part of 1,500 tuning forks. There bells are brought into as accurate tune as is a piano. Properly made bells, once in tune, remain so always.

It is half a day's journey from The Hague to that part of the Singing Tower region far in the northeast of the Netherlands, where purple heather and hills abound.

Groningen, not far from the seacoast, in these higher lands, merits a visit. Here, high up in the tower of St. Martin's Church, we saw one of the finest of carillons.

When we were there a city watchman, as had been the custom for centuries past, spent the night in this tower. Immediately following the ripple of the bells every quarter of an hour, he appeared successively on each of the lofty miniature balconies that face each point of the compass. After all was serene in the sleeping town below, he sent out to north, south, east, and west a faint trumpet strain. And what more restful reminder that "All is well" can be conceived; or what more frugal scheme to let the tax-

Photograph by Emil P. Albrecht

NOTRE DAME CATHEDRAL, ANTWERP, FROM THE SOUTH PROMENADE, THE LARGEST AND MOST BEAUTIFUL GOTHIC CHURCH IN BELGIUM

The church was begun in the 14th century and finished in 1518. The spire is very elaborate. It contains a carillon or 47 bells.

paying burgher know that at least one employé is awake and on his job!

Alas! this ancient custom has now ceased, and the last survivor of the trumpeting tower watchmen, a company that even in recent years has given a medieval touch to many a city of the Low Countries, through the operation of municipal economy, has been retired.

Other explorations took us to Amersfoort, Arnheim, Utrecht, Middelburg, Flushing, Veere and Zierikzee, in each of which towns we found carillons which commanded our interest and invited our study.

And then our journey took us into Belgium.

ONE SCENE OF "LOHENGRIN" IS LAID ON ANTWERP'S RIVER BANKS

Looking out over the trees of the Place Verte, at Antwerp, from the open windows of our hotel we saw the Cathedral spire close enough to us to reveal the

© Donald McLeish

THE MINT TOWER OF AMSTERDAM

This is one of the six Singing Towers of Holland's commercial capital. Its small carillon plays automatically, giving popular airs every quarter hour. The bells are in the open arches above the clock. Amsterdam shows full justification for the name, "The Venice of the North."

delicate details of its beauty, and, above the confusion of the flower market and tramcars in the busy square below, we heard, before the great bell Karolus struck the hour, a lightly falling carillon melody.

Full of poetic associations are the near-by river banks, for it is "On the Scheldt, near Antwerp," that one scene of "Lohengrin" is laid. And majestic are the sweep of space and time and the silence of night, with this music dominating all, that Rosetti has conceived in his poem, "Antwerp and Bruges."

At Ghent, where the bells hang in a separate structure, the Belfry, an intelligent custodian took us up the tower in a modern electric lift. Nowhere else is a carillon tower so equipped, and to those who would gain the height and see for themselves, near at hand, the bells of a carillon of the first order, and its mechanism and the carillonneur's cabin, and yet would avoid an arduous climb, Ghent is commended (see page 373).

Photograph by William Gorham Rice, Jr.

ST. ROMBOLD'S SINGING TOWER, MALINES (MECHLIN), BELGIUM

This is the most important Singing Tower in carillon art (318 feet high) and many think it the most imposing in the world. On its 45 bells Josef Denyn gives his wonderful concerts Monday evenings in summer, when thousands come to listen. St. Rombold's is the Cathedral of Cardinal Mercier.

The carillon of Ghent rang out more than a century ago when, on December 24, 1814, the Treaty of Peace between Great Britain and the United States was concluded.

LONGFELLOW WAS INSPIRED BY BELGIUM'S SINGING TOWERS

Eighty years before Bruges came into our field of exploration, Longfellow, dwelling in Belgium in his student days, had felt the appeal of the Singing Towers. The entries in his diary of 1842, and his poem "The Belfry of Bruges," of which one part is called "Carillon," show the impressions then made upon him.

In the World War the carillonneur of Bruges was of age to serve in the army and, his wife and child having been sent to England, he was compelled, so he told us, to leave the carillon to its fate. When the war was drawing to a close, he found himself near Bruges and asked permission to go and see how his home had

Photograph by Alexander Stewart

BRUGES, SEEN FROM ONE OF ITS MANY CANALS

The 13th century was the epoch of Bruges' greatest prosperity. It was the center of the trade of the Hanseatic League and the chief commercial city of Europe. Everywhere in Bruges the Singing Tower—the Belfry—dominates the scene. It was "in this quaint old Flemish city" that the poet Longfellow, traveling in 1842, came under the spell of its carillon, and as a result wrote the poem, "The Belfry of Bruges," of which one part is entitled "Carillon." In his diary of that May visit he speaks of his evening arrival in Bruges and his rising long before sunrise the next morning to climb the tower; and he describes the great carillon; the singing of the swallows with the bells; the view, as the darkness fled, and the landscape in the fresh morning air, with the canals linking the city to the sea.

Photograph by Edgar K. Frank

A CANAL IN AMSTERDAM, WITH ZUIDER KERK IN THE DISTANCE

This tower contains 35 bells, 32 of which were cast by the Hemonys in 1656. A chime may be described as a section of a few bells out of the central part of a carillon. Bells in a chime may be arranged to swing; bells in a carillon are hung "fixed." English change ringing uses a swinging chime, and every bell for such ringing has its own rope and ringer.

Photograph by Emil P. Albrecht

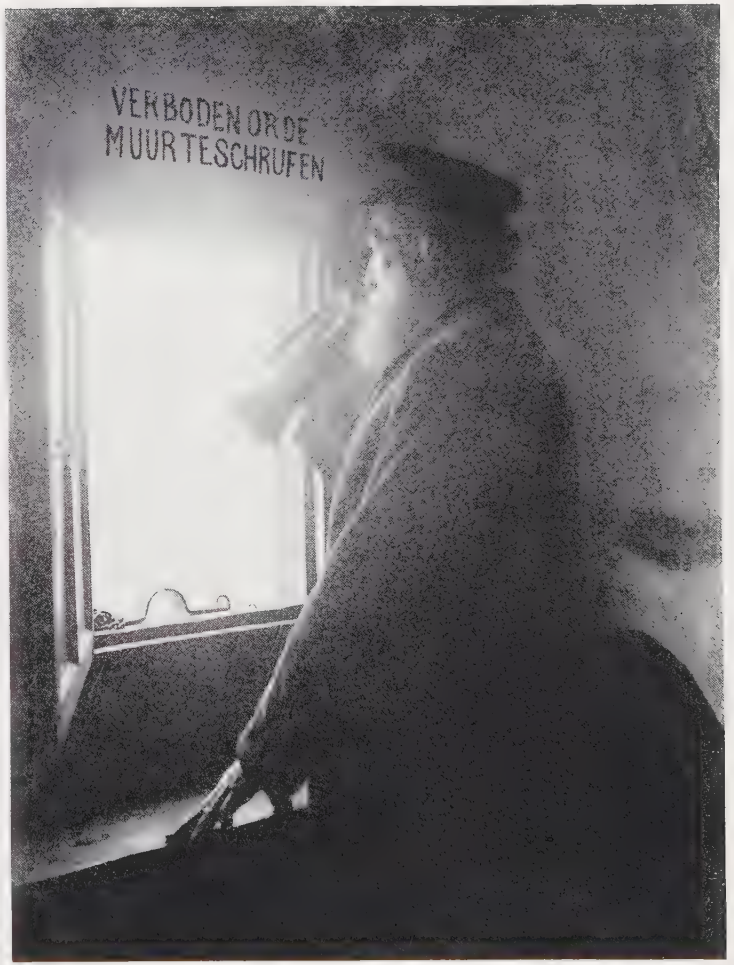
AT THE LEFT IS THE MASSIVE BASE OF THE BELFRY AT GHENT

Just beyond is the Cloth Hall, and in the middle distance is the Cathedral of St. Bavon. In this belfry is a carillon of 52 bells. Among them is the famous "Roland," cast in 1314, recast in 1659, and now again to be recast, as it cracked just before the World War began, in 1914. On it, in Flemish, is inscribed: "My name is Roland. When I toll there is fire; when I peal there is victory in the land."

Photograph by D. J. Van der Vens

THE BELL MAKERS (AFTER AN OLD PRINT)

The two brothers, Pieter and Frans Hemony, the world-renowned 17th-century bell founders, are commonly accepted to have been the inventors of the modern carillon. It was in 1654 that Frans, a well-known carillon and cannon maker, came from quiet Zutphen to live at lively Amsterdam, where the city fathers gave him a foundry site. Other names famous in



Photograph from William Gorham Rice

THE LAST SINGING TOWER TRUMPETER: GRONINGEN

Through centuries every quarter of each hour of the night, in tower after tower, in the Low Countries, a trumpeter watchman, if he saw all was well in the sleeping town below, followed with a faint strain of trumpet music the light automatic play of the carillon. At Groningen this custom continued even until the explorations here recounted by the author
(see text, pages 368-369)

Photographs from William Gorham Rice

SINGING TOWER OF THE METROPOLITAN METHODIST CHURCH, TORONTO, CANADA

Toronto has the distinction of having installed the first bells entitled to be called a carillon in America. There the Metropolitan Methodist Church has 23 bells, mellow in tone and giving two chromatic octaves complete, except the two lowest half notes. The tenor, or largest bell, weighs four tons. The entire weight of the bells of this carillon is 17 tons. It was first played on April 2, 1922, the fiftieth anniversary of the church in which it hangs.

THE SINGING TOWER OF THE PORTUGUESE CHURCH AT GLOUCESTER, MASSACHUSETTS

Our Lady of Good Voyage is the poetic name of this church, in the southern tower of which hangs the first accurately tuned carillon in the United States. It has 33 chromatic bells and these give all the tones and half tones for nearly three octaves. The carillon was first rung in recital on July 23, 1922. The largest bell has a diameter of 3 feet 7 inches and weighs 1,900 pounds, while the smallest is 7 inches in diameter and weighs 19 pounds.

fared. Finding all was well there, he ascended the tower and sought out his beloved bells. There he discovered the wires had been cut, but quickly mending them, he was able, when the King and Queen rode into the city a few hours later, to inspire the crowds below with the strains of *La Brabançonne*.

A CONCERT BY THE PADEREWSKI OF THE CARILLON

Most glorious of all the Singing Towers is that which rises above St. Rombold's noble cathedral at Malines (Mechlin). Appropriately it, too, is the cathedral in which the great Cardinal Mercier officiates.

We arranged our journey so as to reach Malines for the anniversary of the 35 years of service of the distinguished carillonneur Josef Denyn. His skill is indeed marvelous. Well may he be called the Paderewski of the carillon.

Having arrived at Malines early on Saturday evening, we found ourselves in the current of a street pageant in Denyn's honor. Ancient guilds with superb banners and modern societies of every kind marched in the procession. Thousands of people filled the old streets. Houses and public buildings everywhere were gaily decorated.

This impressive pageant was but the beginning of events which filled four days, during which came the inauguration of the School of Carillon Instruction, free to all the world; the meeting of the first Carillon Congress ever assembled; the opening of the Exposition of Carillon Art, lasting through September, and the playing of visiting carillonneurs from France, Holland, and Belgium.

On Sunday noon, in the crowded Town Hall, the burgomaster presented to Denyn a gold medal from the city, and there the American Ambassador to Belgium spoke.

Carillon art attains its noblest expression in the evening concerts by Denyn at Malines. These take place year after year, on Monday evenings, in June, August, and September, from 9 to 10 o'clock.

Malines is midway between Antwerp and Brussels and distant only half an hour from each, so that multitudes from both these cities attend the concerts. Of late many have come also from much greater distances in Europe and from all parts of the world. A program of the music to be played at each concert is published months in advance. And while the great master plays all is quiet, even in the Grand' Place.

That Monday evening, after the hour bell of St. Rombold's Cathedral ceased striking and the vibration of its deep and solemn tone had died away, there was silence. So long a silence it seemed, so absolute, that we wondered if it was ever to be broken. Then pianissimo, from the highest, lightest bells, as if not to startle us, and from far, far above the tower—it seemed, indeed, as if very gently shaken from the sky itself—came trills and runs that were angelic. Rapidly they grew in volume and majesty, as they descended the scale, until the entire heavens seemed full of music.

Seated in the garden, we watched the little light in the tower, where we knew the unseen carillonneur sat at his keyboard and drew the music from his keys; and yet, as we watched and listened, we somehow felt that the music came from somewhere far beyond the tower, far higher than that dim light, and was produced by superhuman hands.

Sometimes the sounds were so low that we found ourselves bending forward to hear them. They seemed to come from an infinite distance, so faint and delicate were they. Then, at other times, great chords, in the volume of many organs, burst forth rapturously!

The concert ended at 10 o'clock with the national air of Belgium. Directly after this the great bell slowly struck the hour.

THE WORLD HAS 180 CARILLONS

In the world to-day are 180 carillons. Of these 134 are in Belgium and the Netherlands. The rest are scattered in other parts of Europe, the United States, and Canada.

Eleven carillons were destroyed in the World War, but already three of these have been replaced.

INDEX FOR JULY-DECEMBER, 1924, VOLUME READY

Index for Volume XLVI (July-December, 1924) of the National Geographic Magazine will be mailed to members upon request.

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THE MOTHER OF RIVERS

An Account of a Photographic Expedition to the Great Columbia Ice Field of the Canadian Rockies

By Lewis R. Freeman

Author of "Surveying the Grand Canyon of the Colorado," in the National Geographic Magazine

IT IS a strange fact that one of the first regions of the Canadian Rockies to be visited by a white explorer was also one of the last to be scientifically investigated and comprehensively photographed. This is the land of tall peaks and glacier-choked valleys around the head of the Athabaska River. Here one finds the most striking Alpine scenery of the Western Hemisphere.

David Thompson, the astronomer-explorer of the Northwest Company, who was later to run the Astors so close a race for the establishment of the first fur-trading post on the Pacific coast of what is now Oregon, crossed the Continental Divide during the first decade of the 19th century. He followed the Whirlpool branch of the Athabaska to its head, and descended to the Big Bend of the Columbia by a stream he named the Portage River, now called the Wood (see map, page 382).

The trail thus blazed later became the main transcontinental route of the Hudson's Bay Company traders between the great Canadian plains and their posts on the upper and lower Columbia.

Thus it chanced that a thin, but fairly steady, stream of travel flowed back and forth across the Continental Divide at the head of the Athabaska during the half century or more in which the remainder of the extensive area covered by the Canadian Rockies was rarely visited by white men.

TRADERS AND TRAPPERS FOUND THE EASIEST ROUTE

Intent mainly on finding the lowest passes and the easiest routes of travel, the early traders and trappers must have been almost, if not quite, ignorant of the existence, a few miles to the south, of the most extensive ice field on the continent, outside of the arctic and subarctic regions of the far north.

The Canadian Pacific blasted its way through the Rockies and Selkirks from 80 to 100 miles south of the Columbia Ice Field, while the Grand Trunk—later the Canadian National—found a lower and easier route as far to the north.

Careful studies for both lines added little, if any, knowledge of the still untrodden heights of the ice-locked *terra incognita* between.

Not until the Interprovincial Survey completed its labors along the Continental Divide between Alberta and British Columbia did definite and dependable data on this hitherto almost unknown region finally become available.

Among many valuable geographical and topographical facts revealed by the work of the Interprovincial Survey, per-

Photograph by Byron Harmon

BOW LAKE CAMP, WITH BOW GLACIER ON THE SKY LINE

"Across a milky-jade lake surface gently ruffled by the evening breeze was a wall of ice and rock culminating in the solid mass of Bow Glacier, which reared its bottle-green snout above a gray boulder-fan streaked with glittering runlets of tumbling water" (see text, page 393).

haps none was received with so much surprise and interest, even by those who knew the Canadian Rockies, as the statement that the Columbia Ice Field, formerly not known by name to one person in a hundred thousand, has an area in excess of 150 square miles.

DRAINAGE FROM THE VAST COLUMBIA ICE FIELD FLOWS TO THREE MAJOR OCEANS

Of even greater appeal to the imagination was the revelation of the hitherto little appreciated fact that drainage from this single ice field flows to three major oceans—probably the only instance in the world where such great dispersion of water from a common source occurs.

The Columbia Ice Field may be roughly likened to a stockily built octopus, with the main *mer de glace* forming the body, and the creeping, down-crawling glaciers the tentacles. Surrounded by peaks varying in height from 10,000 to more than 12,000 feet, the ice field itself is comparatively smooth and level. Indeed, many square miles of its center are not more rolling than an undulating plain.

The average elevation, exclusive of the

Photograph by Byron Harmon

THE AUTHOR RELEASING A CARRIER PIGEON AT BOW LAKE

A message was typed on oiled paper and slipped inside the leg ring. A pair of birds was released. They rose for 1,000 feet, then started in the direction of their home cote, but they have never arrived (see text, page 398).

glacier tentacles, which extend down toward the 6,000-foot contour, is about 8,500 feet above sea level. Its greatest elevation is a hummock of 8,884 feet somewhat north of its center.

THE GREAT THREE-WAY SPLIT TO THE ARCTIC, ATLANTIC, AND PACIFIC

Here occurs the remarkable three-way split of continental drainage.

Where the tip inclines westerly, the water runs by the Bush to the Columbia, and thence to the Pacific.

The meltage from the northerly slope may run to either of the main branches of the Athabaska, and so on to Great Slave Lake and down the Mackenzie to the Arctic Ocean.

The eastern and southern slopes drain to separate branches of the Saskatchewan, which, uniting 25 miles below, ultimately mingle with the Atlantic through Hudson Bay.

Striking scenically, unique topographically, and barely explored, the Columbia Ice Field has few rivals in its attractions not only for the alpinist, but also for all lovers of the outdoors.

This article is a workaday account of the first attempt to make a comprehensive collection of photographs, motion and still, of this wild and wonderful region.

Photograph by Byron Harmon

BAPTIE AND THE AUTHOR SUNNING THE CARRIER PIGEONS

The Nature photographer cannot block out a region on the map and say, like the explorer or the surveyor, "When I have covered this area my work is complete." He can cover all of Nature's subjects, but can never reach the end of her moods.

And the recording of moods—the savagery of the mountain torrent which grinds down and engulfs the tongue of forest that blocks its way; the perversity of the peak that hides its head in a veil of cloud—is his most subtle vehicle of expression.

A life-span is all too short for the artist who would picture, either with brush or camera, a land or a race. Byron Harmon's successful expedition to photograph the Columbia Ice Field last summer and fall is the crowning achievement of 20 years spent in picturing the Canadian Rockies, but it does not mark the end of the work.

My first meeting with Harmon was in the summer of 1920, at a camp on the iceberg-battered shores of that incomparable mountain gem, the Lake of the Hanging Glacier.

It was there that I first heard of the Columbia Ice Field. Harmon had never seen it himself, but had been told enough of it by mountain climbers who had made ascents within sight of it, to lead him to believe that the region was probably the finest scenically in all the Rockies.

Because it was remote and difficult to reach, he was saving it for the summer of his 20th year of photographing in the Rockies. With a properly equipped expedition, he hoped to be able to cover all of the region along the Continental Divide where he had not worked hitherto with his cameras.

In the spring of 1924 Harmon wrote me that he had completed his preliminary plans for his Columbia Ice Field trip, and he asked me to join him and aid in making the motion-picture film.

A JOURNEY OF OVER 500 MILES FROM BANFF TO THE ICE FIELD AND BACK

With a jaunt of my own already planned—to drive a small motor boat from Chicago to New York by way of the Great Lakes and the St. Lawrence—some rearrangement of schedules was necessary to make both trips possible, but ultimately I was able to dock in New

York in time to swing back to Canada and arrive at Banff by August 15. A pack train was already assembled at a camp on the Bow River near Lake Louise.

The route laid out for our trip followed the Bow to the lake and glacier of the same name at the Continental Divide. Thence it paralleled the Divide, as closely as topography would permit, until the Columbia Ice Field was reached, at the head of Castleguard Valley.

After a month or more of work on or near the ice field, including a crossing of one spur with pack train and a circuit to the head of the Athabaska, under Mount Columbia, on its northern side, winter clothes and supplies would be picked up at Jasper and the return journey of 200 miles to Banff made by the best available route through the early snows.

Photograph by Byron Harmon

A BUCKING HORSE "BROADCASTING" THE RADIO

The cedar box containing the supposedly fragile outfit underwent this terrific bombardment from the hoofs of a temperamental pack animal, yet the set survived (see text, page 399).

It was expected that this itinerary would require 10 or 12 weeks, owing to enforced waits for favorable picture weather, and the fact that nothing worthy of the name of trail would be available for any considerable sections.

Two features of the proposed itinerary impressed me as verging closely upon the impossible: The plan to take the horses across the ice field and the expectation of marching for two or three weeks of the return journey through a region of high elevation, where not only the passes, but many of the valleys as well, would be deep in snow.

As to the ice-field traverse, I was told that such a crossing had been safely made the previous summer by the pack train of a mountain-climbing party. Therefore, there was no reason to believe it could not be done again, especially since one of our packers had been with the pioneer outfit.

As for the long snow journey, Harmon thought it worth while to face its rigors, since neither moving pictures nor stills had been made previously of such a passage over the high Rockies.

HARDSHIPS FORESEEN; SPECIAL EQUIPMENT SELECTED

As we expected to encounter high water and ice on the outward trip, and heavy snows during the return, we had every

Drawn by C. E. Riddiford

ROUTE OF THE COLUMBIA ICE FIELD PHOTOGRAPHIC EXPEDITION

From this ice field of 150 square miles, on the Continental Divide, waters flow north, east, and west into the Arctic, Atlantic, and Pacific oceans (see text, page 378).

reason to anticipate one of the severest journeys ever attempted with a pack train in the Canadian Rockies. Great care, therefore, was taken that the outfit, as to personnel, stock, and equipment, should be of the best.

With years of personal acquaintance among the guides and packers of the Rockies, Harmon engaged the three best suited to our special needs. They were all mountain men of long experience. One, La Casse, was well acquainted with the region to be traversed as far as the Columbia Ice Field and on to the Athabaska Glacier and Wilcox Pass.

The men were informed in advance of the plans and itinerary and warned that the picture work would inevitably be responsible for delays, difficulties, and discomforts not usually encountered on hunting and camping trips.

The horses, picked long in advance, had been kept off the trail all summer to conserve their strength for the arduous and punishing work ahead. This was most fortunate, for the long weeks of semistarvation in the snows of early winter, with endless hours of desperate floundering in deep drifts of the high passes, demanded all their stamina.

Besides a motion-picture camera, with its varied assortment of lenses and 8,000 feet of film, Harmon and I had each two still cameras, with an ample supply of roll and cut films.

The motion-picture film and my roll films were carried in sealed tins. Harmon's huge reserve of cut films, by some oversight, was sent in ordinary wrappings, thereby causing much anxiety during the days when we encountered mud and high water.

The only real weakness in the outfit was its lack of water-tight boxes and bags. The pack-boxes for the motion-picture camera and its accessories would afford adequate protection from hard knocks, but would not exclude water. Neither would the grub-boxes or the sackings for the food supplies.

As a consequence, when we were confronted unexpectedly by severe high water, we lost more supplies in two days than the recent U. S. Geological Survey expedition lost in its three months' voyage through the rapids of the Grand Canyon.* Even at that, however, we were never seriously handicapped by a shortage either of food or of photographic supplies.

RADIO, CARRIER PIGEONS, AND A TYPEWRITER THE ONLY LUXURIES

With luxuries cut to the bone, since no replenishment of supplies would be possible within six or eight weeks, our only real frills were a radio set, carrier pigeons, and a typewriter.

The little portable Radiola was my own idea, born of the memory of the entertainment which the Grand Canyon party had derived from a similar outfit a year previously.

The carrier pigeons were Harmon's idea. He had been breeding "homers" at Banff for a year or more, but had never had a chance to try them out in the mountains. The present opportunity was too good to be missed. Besides, there was always the chance that we would be glad of a way to send a message by air, in the event ordinary means of communication became impracticable.

* See "Surveying the Grand Canyon of the Colorado," by Lewis R. Freeman, in the NATIONAL GEOGRAPHIC MAGAZINE for May, 1924.

Drawn by C. E. Riddiford

A SKETCH MAP OF CANADA: SQUARE SHOWS THE AREA COVERED BY THE MAP ON THE OPPOSITE PAGE

The birds would also prove useful for reporting on radio conditions. Several powerful stations had promised to make special efforts to reach us, in the event the Rockies area did not prove entirely "dead," as there had been some reason to believe.

Neither Harmon nor I knew more about carrier-pigeon technique than we did about that of radio. All we could learn locally was from an old children's bird book, which stated that the door of the home cote should be of valvelike construction, permitting the ingress of the returning bird, but not the egress. The boxes in which the pigeons were carried, we read, should be provided with holes large enough to admit plenty of air, but not so big as to allow the birds to escape before their time. Both of these admonitions seemed reasonable.

Less convincing was the instruction that the message should be written on waterproof oiled paper and wrapped securely to one of the bird's tail feathers. As the only line I had on this point was a hazy memory of the picture on a childhood valentine of a dove with a very plump packet dangling from its neck, I was diffident about disputing the practicability of the tail-feather plan.

We purchased a stock of oiled paper on the theory that it might better resist the disintegration of possible fogs or

Photograph by Lewis R. Freeman

A WILD VISITOR INSPECTS THE EXPEDITION'S RADIO

A doe, following the horses into Bow Camp, took advantage of the occasion to satisfy her curiosity (see text, page 395).

Photograph by Byron Harmon

WATERFOWL LAKES, WITH PYRAMID PEAK BEYOND

The shores of these lovely twin lakes are so marshy that one could not dip a cup of drinking water from either without running the risk of being mired. The upper and lower lakes are joined by the gleaming ribbon of the Mistaya River (see text, page 402).

Photograph by Byron Harmon

BUSTER RIDING A SWIMMING PACK HORSE ACROSS THE FLOODED SASKATCHEWAN (SEE TEXT, PAGE 406)

rains, but fortunately we tried it out before starting, and learned that even the softest pencil point would skid along the polished surface without leaving the vestige of a mark.

That was why my little folding typewriter was requisitioned at the last moment to fill the breach. A sharply struck key left an impression on the tough, smooth paper which resisted blurring, even under the hard rubbing of a moist finger tip.

LETTING "NATURE TAKE ITS COURSE" ON THE EXPEDITION'S BAGGAGE

The unexpected addition of radio and carrier pigeons, with their accessories, together with two extra cases of photographic supplies, swelled the baggage to a volume that demanded the increase of our 16-horse pack train by two or three head. With no animals of the sturdy breed necessary for the rough work available at Lake Louise, "Soapy" Smith, head packer and owner of the stock, philosophically decided to divide the extra load among the horses he had, adding that we could "let Nature take its course" in reducing the loads to proper proportions.

I innocently supposed this cryptic remark referred to inroads our appetites would make upon the grub supply, but, as the sequel proved, our trail-wise mountaineer was thinking of what happens to overly bulky packs in traversing a land of muskeg (marsh) and fallen timber.

We encountered close-growing timber as soon as we turned north from the railway line, and the first nine miles up the swampy flats of Bow River were a fitting initiation for the stern work coming.

One of the first packs to be knocked under a horse's heels, by colliding with the limb of a half-fallen tree, originally consisted of cases of jam and baking powder, with the insulated wire for the radio aërial riding between. Only the tangled antennæ materials preserved their identity so as to be recognizable after the terrible mauling under new-shod hoofs.

The preserve-smeared and powder-dusted loops were, nevertheless, still in a condition to lend point to old Soapy's atrocious attempt at a joke.

Photograph by Byron Harmon

THE PACK TRAIN ENTERING AN UNEXPECTEDLY DEEP CHANNEL OF THE SASKATCHEWAN

Both packs and men received an icy drenching when the horses were rolled under the caving cut bank on the right. This photograph shows the author leaving his saddle to give a floundering horse a chance (see text, pages 406-407).

"If that geesly radio don't 'jam' again when she's set up," he drawled, "this anointing ought to qualify her for broadcasting some right snappy baking receeps!"

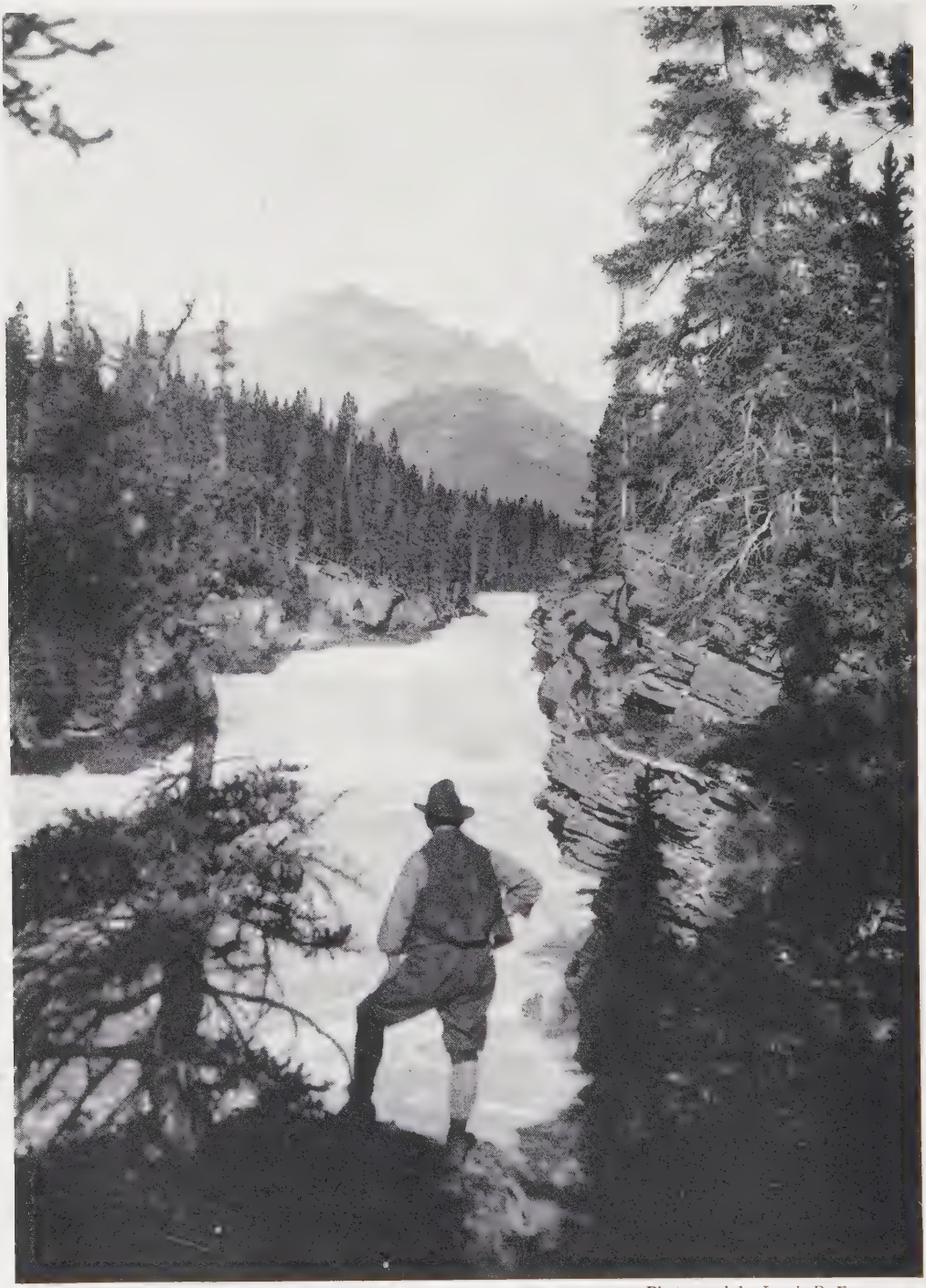
THROUGH BOGS AND FALLEN TIMBER

Between mud and devious windings among deadfalls, our progress that first day was painfully slow. Now a horse was bogged to its belly; now a pack jammed tight between two close-growing trees, while its bearer struggled on through; now, with all signs of a trail gone, the whole train would scatter through the timber. We were six hours making nine miles.

Everyone was so busy finding strayed horses and scattered packs that the ever-heightening western wall of the Rockies, with its shimmering fingers of glacial ice clawing for precarious holds above the valley of the Bow, unfolded its brilliant panorama almost unnoticed.

Making camp in drizzling rain, we took stock of the first day's attrition. With stoutly boxed and sacked stuff, salvage had been almost complete. The losses were chiefly in our stocks of baking powder and dehydrated vegetables, especially where the packs had gone to pieces in mud or water. Wet baking powder was, of course, gone forever, but in the case of dampened dried fruit and vegetables, the result had been to increase volume far out of proportion to the actual loss.

Nature had taken its course, but, far from acting in the way Soapy anticipated, our packs had increased in volume, if not weight, by 5 or 10 per cent. This meant that the packs would be larger than ever for a few more days. But Soapy's hour was to come.



Photograph by Lewis R. Freeman

WHITE WATER IN BOX CANYON OF THE NORTH FORK OF THE SASKATCHEWAN

Here the water rose from 20 to 25 feet in three days; cascades were wiped out by a solid white stretch of tumbling torrent (see text, page 408).

Photograph by Byron Harmon

FLOUNDERING HORSES AND SWIMMING DOGS IN THE ALEXANDRA RIVER

Several animals were carried downstream 100 feet or more, but luckily found sloping bars upon which to clamber to safety (see text, page 427).

Finding it no longer possible to continue up the half-flooded flats of the Bow, the following morning the horses were dragged and shoved for 500 feet up the steep eastern wall of the valley to where a narrow trail had been blazed many years before. It was a desperately hard scramble for loaded animals, and far from soft work for men.

MOVING BOULDERS AND AVOIDING AVALANCHES

Every few feet hair-poised boulders, left by the slide whose wake we followed, had to be rolled aside to give footing to the scrambling horses. To turn a rock over and prop it up to prevent its rolling down a 50-degree slope on to a pack train strung out below are operations that require both care and judgment, to say nothing of strength.

By keeping very much in open order and out of a direct line below the point where active road work was in progress, we managed to avoid pieces of rock which went adrift and headed little avalanches to the valley.

We had too much of the same sort of mountain-side work in loose rock with the pack train before the trip was over, and, speaking personally, I was never able to stir up any enthusiasm for it. With each of the four floundering feet of 16 horses (not to mention those of five men and two dogs) a potential starter of a moving mountain side, the feeling engendered is far from the one of comfortable placidity that comes with the reassuring clasp of a rope on the rim of a 100-foot crevasse.

The trail which we labored so hard to gain proved to be the almost obliterated remains of what had been only a wretched track at best. It was blocked here and there by fallen timber, which had to be cut away whenever presenting too high a barrier for the horses.

Congratulating ourselves on the fact that the well-drained mountain side would at least give better footing than the bottomless muskeg, we started worrying the train along through the prostrate tree trunks as best we could. We had made about a mile when an innocuous-looking

Photograph by Byron Harmon

FORDING THE ALEXANDRA ON FOOT TO RECOVER PACK HORSES

The current was too strong for one man alone, so a human chain was formed.

patch of moisture, where a limpid springlet dribbled out, proved that these anticipations were premature.

La Casse, on foot, was in advance of the train, leading a wiry little buckskin called "the Rat." Because of his surefootedness, the Rat had been given the highly responsible task of carrying the pigeon box, a frail packing case of corrugated pasteboard, lashed to ride high up on top of a bulky pack of bed rolls.

THE PIGEONS AND A HORSE ARE RESCUED FROM A BOG

We figured the box was worth the trouble it was giving us in maneuvering clear of overhanging limbs to have it as high as possible in case the Rat had to swim at a ford or became deeply bogged.

Now this was soundly reasoned, but held good only so long as the Rat remained right side up. When that shifty ex-Indian cayuse found the trail under him suddenly resolving into a bottomless patch of soft mud, he tried to get out of it by rolling. Nothing less than the quick-witted cook's catlike leap and flying tackle saved the flimsy pigeon box and contents from being rolled as flat as a pancake.

The birds were freed with hardly more than an upsetting of their water-can, but the case of their late bearer was serious. He wallowed until his head was folded

Photograph by Lewis R. Freeman

A FLASHLIGHT OF A CAVE IN THE CANADIAN ROCKIES

From this recess issues, at times, a large part of the flow of Castleguard River. Byron Harmon is seen with his motion-picture camera.

back under his body; then, with all four legs sticking straight up in the air, he surrendered to fate and began resignedly to strangle.

Rob, the wrangler, had already thrown a hitch over the forelegs and was pulling down the trail, when Soapy, dashing into the scene from above, lassoed the hind legs and set his mount pulling in the opposite direction. It was decidedly rough on the Rat, but in the end it proved his salvation.

Drawing himself together before he was completely pulled apart, he kicked free from Soapy's hitch, turned a complete somersault, landed on his feet, and bounded along in the slithering wake of Rob.

The Rat was a tough little brute. An ordinary horse could hardly have been less than drawn and quartered by so terrific an experience, but he showed almost no ill effects for a while. Later, it became evident that there must have been some injury to his back, for he was never able thereafter to raise his rear hoofs more than a foot from the ground when trying to kick. Yet even this trouble never affected his usefulness as a sturdy pack horse.

Tall, slender, extremely dense timber screened all but occasional glimpses of a gray-green sheet of water widening across the valley floor below. This was Hector Lake, named for the physician and explorer with the Palliser Expedition, which made the first scientific exploration of the passes of the Canadian Rockies in 1858.

This lake is fed by a stream from the Hector Glacier, which extends from the summit of the Waputik Mountains, as the main chain of the Rockies is called in this region, and drains to the Bow, which, at high water, covers the low, level valley flats to the south and east with a lake of its own.

Passing out of the heavy timber, a half mile among the chaos of piled rocks and upended tree trunks, where snowslides of many centuries have left their accumulated scourings at the foot of the mountains, we crossed the boulder-choked

Photograph by Lewis R. Freeman

ON THE CLIMB TO MOUNT CASTLEGUARD

Laden with cameras, the trio is seen avoiding a crevasse on the dangerous ascent (see text, page 433).

channel of Mosquito Creek. Then we descended again to the flats of the Bow.

In spite of several fordings of the deep, swift river, the going here was the best since leaving Lake Louise, due principally to the fact that, with the valley floor sloping at a sharper declivity, more water had been drained out of the clinging, blue-gray glacial silt with which it was paved.

THE SCOURGE OF GLACIAL SILT

First and last, glacial silt was the most annoying obstacle we encountered on the whole journey. The main by-product of the grinding mills of the ice makes the muddiest mud, as well as the dustiest dust, with which I have ever had personal contact. Like the mills of God, those of the glaciers, though they grind but slowly, "yet they grind exceeding small."

The dust is so impalpable that it will filter through the closest-woven canvas; the mud, at its worst, offers no resistance whatever to the downward passage of the foot or body of horse or man. Once into it, one goes straight on to bedrock, unless he has help or is so fortunate as to encounter some extraneous body, like the trunk of a tree.

Our packers claimed that glacial silt had one use. It was a wonderful abrasive—had no equal, in fact, when used as a paste on razor strops. Not having shaved during the trip, I had no chance to test this single virtue of the pestilential stuff. As to its abrasive effect on tempers, however, I can testify from a full heart.

We followed the winding ribbon of the Bow until mountain meadows, gay with flowers, gave place to the narrow and precipitous canyon which drains the lake above. Then we were forced to ascend to a series of sloping benches to the north for another miserable stage in bogs and fallen timber.

Climbing slowly but steadily, we skirted the attenuated finger of the lower lake, passed the swift-flowing narrows above, and came out at the end of the afternoon upon the firm, pebble-paved beach looping in the easterly arm of the upper, or main, Bow Lake.

The scene which burst upon us, after the wearisome struggle with an all but

exhausted pack train in the black inferno of burned timber and mudholes below, was of an unearthly loveliness.

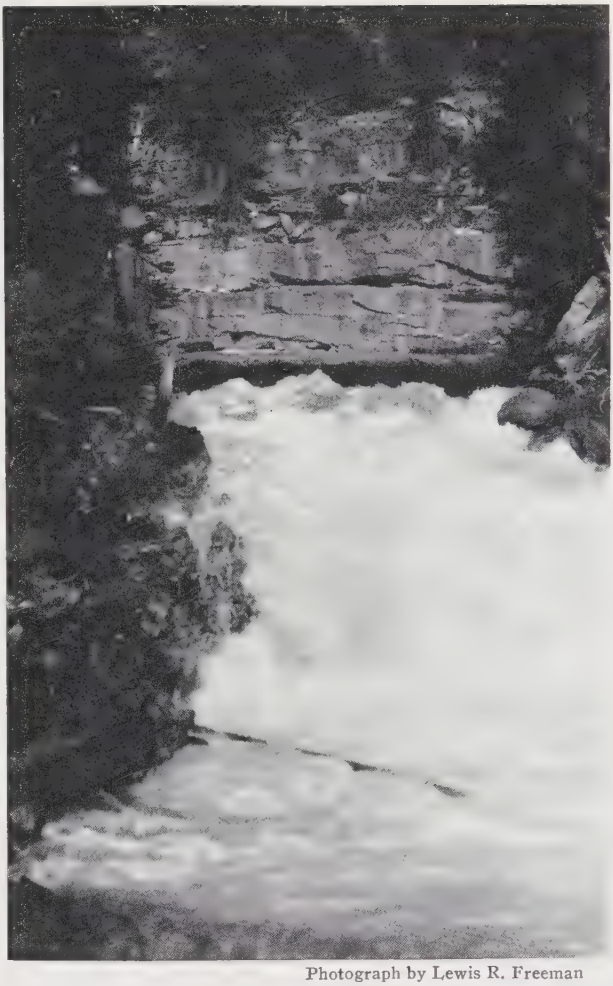
THE SCENIC BEAUTY OF UPPER BOW LAKE

To our left was the weird Crowsfoot Glacier, clutching with icy talons the precipitous slopes of towering Bow Peak to keep from falling into the foam-white rapids of the narrows below. To our right, a long, gently sloping wedge of meadow, dark green and brown and mottled with shadows of low-lying bushes and clumps of snow-stunted pines, led up to the broad notch of Bow Pass.

Through this defile could be seen pinnacles of the snowy peaks across the Saskatchewan, floating, sun-sharpened, against the blue haze.

Ahead, across a milky-jade lake surface gently ruffled by the evening breeze, was a wall of ice and rock culminating in the solid mass of Bow Glacier, which reared its bottle-green snout above a gray boulder-fan streaked with glittering runlets of tumbling water.

Two great waterfalls, flanking the face of the glacier to left and right, showed perpendicular shafts of gleaming white, round and solid, like the marble pillars supporting the arch of a Grecian temple.



Photograph by Lewis R. Freeman

A WATERFALL GUSHES FROM THE MOUNTAIN SIDE TO PLUNGE INTO THE ALEXANDRA VALLEY

The stream from this fine cataract seemed to furnish more than half the flow of the entire Alexandra River (see text, page 428, and illustrations, pages 389 and 390).

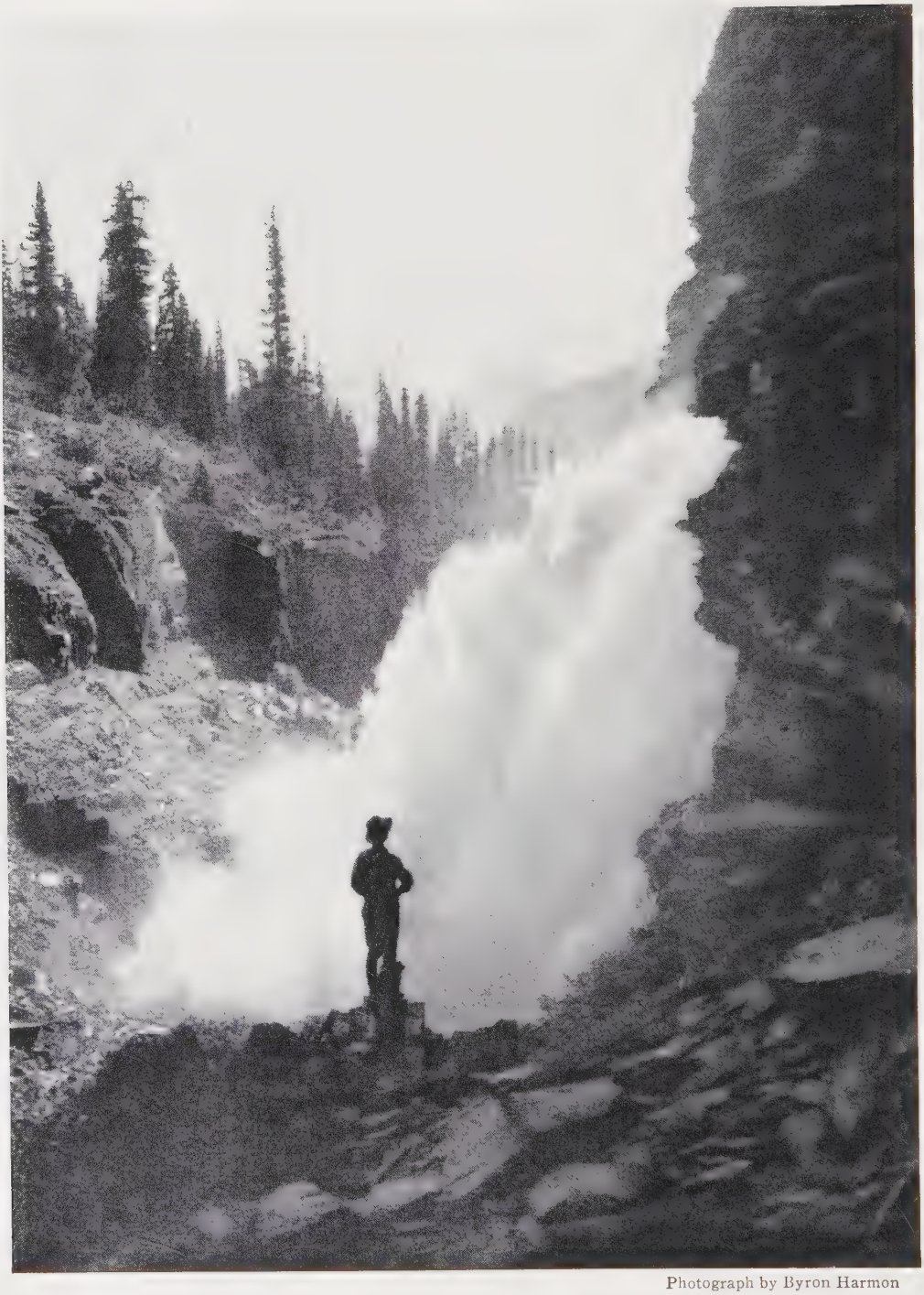
The slanting afternoon sunlight formed concentric circles of rainbows in the mist-whorls rising from the foot of the twin cataracts, before striking through to prick with opalescent gleams the dancing wavelets of the lake below.

A camp site in the northern Rockies demands not only a fairly level and comparatively dry place for the tents, but also good grazing for the horses within reasonable distance. With none of these essentials available where we were, we had to push on until they were found.

The fact that we had already been eight hours on the road, where four or five of such travel was all a pack train should be required to endure, had nothing to do with the situation.

THE MUD WINS THE FIGHT

The mountain side sloping to the east end of the lake proved to be honeycombed with bubbling springs, clear and beautiful, but potential morasses for the weary horses. At the end of a quarter of a mile, with half of the animals down and all of them near the end of their strength, we gave up the fight with the mud and dragged them, one at a time, down to the lake.



Photograph by Byron Harmon

CASTLEGUARD FALLS WITH MOUNT LYELL IN THE DISTANCE

"A 20-foot cascade on the river above the camp and a 100-foot sheer fall just below were the crowning touches in a picture etched deep on the tablets of memory" (see text, page 429).

THE AUTHOR (LEFT) AND HARMON (RIGHT) GETTING THE STOCK REPORT BY RADIO

Station KGO, Oakland, California, afforded this service to the ice-marooned explorers. A complete opera rehearsal in San Francisco was also heard through the Oakland station.

There was no beach for the next mile, but, with the bottom solid and the water not over 10 to 20 inches deep, it was possible to make slow but steady progress.

Splashing and floundering over slippery rocks, we skirted the leaking mountain side, only to find the ground becoming soft and soggy where the little valley ran back to the summit of Bow Pass. What had looked like a pretty meadow a mile away turned out to be brushy muskeg, with a narrow, steep-banked stream winding back and forth across it like the wake of a wounded snake.

With several horses ready to quit every time they bogged down, we were nearly an hour wallowing across the last half mile. Then we pushed through a forest of fine old spruce to a protected and beautiful camp site a few hundred yards back from the north side of the lake, with Bow Glacier, rosy-pink in the sunset glow, reared against the sky line.

Rain in the night, turning to snow after dawn, was followed by a day too overcast to make picture-taking practicable. Snow on August 20 was a significant reminder of how near winter stalks in the northern Rockies, even in midsummer.

THE RADIO INTERESTS WHITE-TAILED DOES

We erected the radio in the afternoon, with the aërial between two lofty pines, and were rewarded by vigorous wails from the ether, which gave promise of better things when we should have time to make a careful set-up.

However, we learned enough to reassure us on two important points: This section of the Rockies is not in any sense a "dead" area, and the terrific banging the radio outfit received had not seriously impaired its usefulness.

Our most interesting radio reception of the day, however, had nothing to do with the ethereal messages. During the forenoon salt had been thrown for the horses on the patch of grass where the radio was set up later in the day. Two or three times in the course of the afternoon several horses straggled down from the meadow above for another grateful lick of salinity. The last time they were

Photograph by Byron Harmon

A CAMP-MADE LOUD SPEAKER IN THE CANADIAN WILDS

A baking-powder tin and a coffee can whined forth the early evening news.

accompanied by two splendid white-tailed does, the first deer we had seen.

Taking our cameras and backing off unobtrusively into the timber, Harmon and I left the salt lick, and incidentally the radio, to our graceful lady visitors. The strange-looking and smelling box made a greater appeal to the curiosity of the pretty pair than did the salt to their palates. They stepped around and around the wonder in narrowing circles.

By the time we had slipped and slid along into a position suitable for pictures, one of them had satisfied her curiosity and gone back to munching the salty grass.

The other, when I snapped at 100 feet, was standing with extended neck, her sensitive nose sniffing not many inches away from the dials (see illustration, page 384). Stalking still closer, I was about to snap again when a snort, ripped out at the edge of the timber, sent both our afternoon-salt guests bounding away. Their lord and master had ordered his ladies home.

Another night with snow flurries gave way to a day of ideal mountain photographic weather—sunshine and squalls. With our full battery of cameras in action, we photographed the lake and its ice-crowned sentinels, mood by mood, from daylight to sunset.

There was an hour of repose in early morning, when every glacier and rock and pine-clad point was reflected, to the last detail, in the glassy, unrippling surface. Then there was a spell of smiling under the golden glow of the light-suffused eastern clouds, followed by a madcap dance of mirth and laughter, with the direct sunlight turning the breeze-stirred waves to shoals of diamonds and emeralds.

Laughter gave way to frowning, when shoal on shoal of murky thunderclouds poured over the Continental Divide and quenched the golden sunshine under a swiftly flung pall of sudden night; and when another wild blade of a free-lancing squall came bounding up the valley of the Bow and attacked the first in the middle of the lake, bluster and frown gave way to real tantrums.

No star of the movies ever registered more moods and expressions between

Photograph by Byron Harmon

GIVING BUSTER A DOSE OF RADIO-CAST JAZZ

daylight and dark than this lovely Lady of Bow Lake. By dint of much cranking and focusing, we transferred them to celluloid.

THE WAYS OF A WIND WITH A MOUNTAIN LAKE

A flareback of the tantrum mood caught Harmon and me and the cameras in midlake in a diminutive homemade boat, while I was trying to pull across to get a close-up of the Crowsfoot Glacier. There were a few hectic moments when we were vividly reminded of that classic description:

> "De win' she blow from nor', eas', wes',
> De sout' win' she blow too."

With the lake trying to stand on end, and a flimsy craft that changed shape every time I laid hard on to the oars, there wasn't much to do but try to keep the so-called bow toward the highest wave of the mad moment. That, and Harmon's lively baling, sufficed by a margin not quite comfortable.

Nor were our apprehensions entirely on the score of the negative buoyancy of the movie camera. It takes a very warm-blooded man not to chill in swimming more than 100 yards in glacier water, and we were a good half mile offshore.

We had no trouble reaching land, once the center of the squall went about its business.

The lesson in the ways of a wind with a mountain lake came in good time. It

Photograph by Lewis R. Freeman

A PACK LASH-ROPE SUPPORTING THE RADIO AËRIAL WIRE FROM TEPEE POLE TO PINE TREE

prevented us from trying the same kind of argosy on other waters that were broader and deeper and just as cold as that temperamental patch of drippings from Bow Glacier.

THE FIRST PIGEONS ARE LAUNCHED

As the sky cleared toward the end of the afternoon, we prepared to release our first pigeons. The messages, giving names of the radio stations already picked up and additions to lists of supplies to be sent us some weeks later at Jasper, were typed on the oiled paper.

After pulling loose several tail feathers in an endeavor to attach the tightly folded slips as directed by experts, we finally slipped them inside the leg-rings worn by each bird to carry its registered number. Tied with silk threads, the tiny rolls appeared to ride securely.

Two birds — a pair — were released simultaneously. Teaming up at once, they rose in widening circles for perhaps 1,000 feet, and then made off, apparently with great confidence, on a line a bit easterly to the general direction of the valley of the Bow. As this was almost the exact compass bearing of Banff, we felt certain they would soon be pecking at the door of their home cote.

Just why they failed to fulfill our hopes we never learned. The chances are that, failing to find—or possibly failing to effect entrance after finding—their former home, they went in search of another.

Photograph by Byron Harmon

JUST AFTER COMING ON TO SASKATCHEWAN GLACIER

"The horses, although in fine fettle after five days' feasting among the juicy mountain-meadow grasses, took the work seriously and showed little desire to bolt or hang back. Plainly, the strangeness of their surroundings and unstable footing had a sobering effect" (see text, page 437).

Whoever found the pigeons apparently kept them.

THE RADIO BOX GETS A TERRIFIC MAULING

Three days' rest with prime grazing had made a great difference in the horses by the time we broke camp again on the 21st. Though travel conditions continued no less arduous than before, much steadier progress was made. Bow Pass, a little below timber line, was reached and crossed by an easy grade. The descent to the valley of the Mistaya—rough, abrupt, and slippery — was effected with the knocking off of only two or three packs.

One of these included the radio, however. The cedar box containing this delicate and supposedly fragile outfit came in for a terrific mauling under the hoofs of a panicky pack horse (see page 381).

Abandoning hope of ever reassembling a wreck which, like Humpty Dumpty, might well have defied the best technical efforts of "all the king's horses and all the king's men," we simply roped up the shattered case and took the contents along as a movie "prop."

A herd of a dozen deer, offering easy targets as they watched us file over the summit of the divide, were not molested, for we were still too heavily packed to carry meat, and we were about to enter a region in which at almost any point an hour's climb with a rifle would result in a goat or sheep. We had neither time nor inclination to shoot for trophies.

Park boundaries, touched and crossed at several points, interfered at first with shooting for meat whenever a shortage occurred. As soon as pack room was available, however, it was easy to lay in a sufficient supply in the open sections to carry us through those in which shooting was not legal. Meat keeps a long time in these high, cold altitudes.

The Mistaya was a roaring, boulder-strewn torrent where we first came down to it, but at the end of a mile it broadened out into meandering channels emptying into the head of Upper Waterfowl Lake.

Photograph by Byron Harmon

PASSING SIDE GLACIERS WHILE TRAVERSING THE LENGTH OF SASKATCHEWAN GLACIER

Before going out upon the ice, the horses had been tied head to tail in groups of three or four, each group being led by a man on foot.

Photograph by Byron Harmon

THE SNOUT OF SASKATCHEWAN GLACIER, SHOWING THE TERMINAL MORAINE

The party left the surface of the glacier some distance above the snout, as the number of crevasses made the going increasingly dangerous.

Photograph by Byron Harmon

A PORTION OF THE PACK TRAIN TRAVERSING BROKEN ROCKS, AFTER COMING OFF SASKATCHEWAN GLACIER

Several horses were injured here, and the loss of two was narrowly averted (see text, page 439).

Several deep fordings and a long, wet wade through boggy marshes took us to a precarious camping ground among the burned timber on the sloping mountain side east of the head of the lake.

The shore, beautiful to the eye, especially from a high altitude, was too boggy to permit even the dipping of drinking water without risk of being mired.

We remained here for a day in order to climb a few thousand feet to the summit of the easterly ridge for a vantage from which to take pictures of the splendid panorama of Howse Peak and Pyramid, with the silvered slivers of the Upper and Lower Waterfowl lakes, harnessed in tandem by the gleaming ribbons of the Mistaya's channels, prancing in the sunlit foreground (see page 385).

NELLY, THE FILLY, SUMMARILY REDUCES THE WEIGHT OF HER PACK

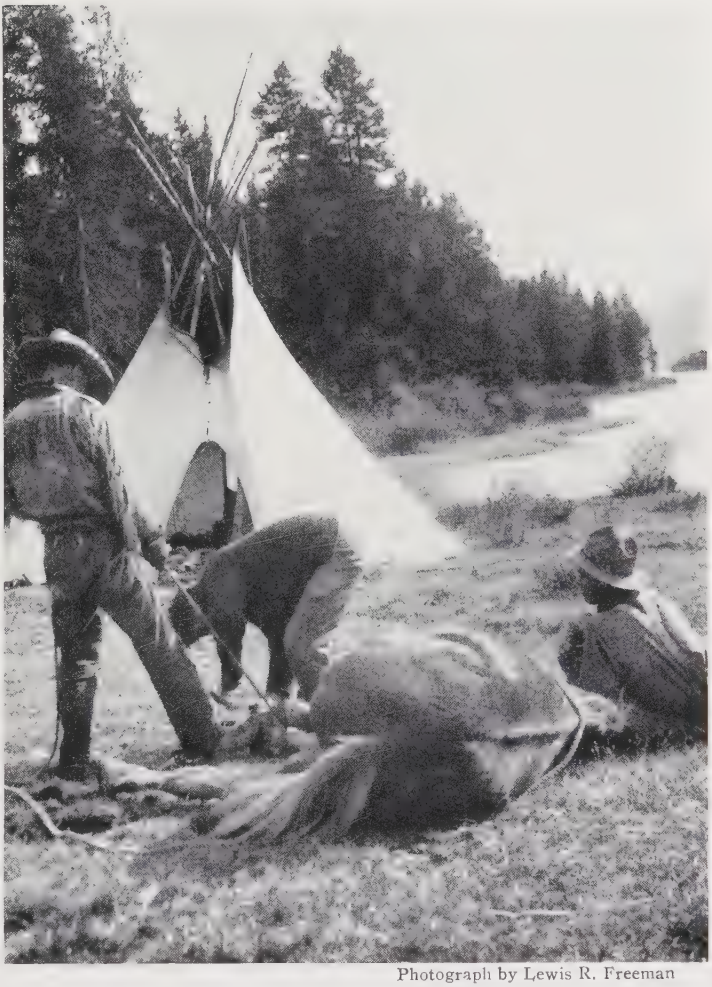
As it was impossible to ford the Mistaya in the canyons below, the only practicable route to the Saskatchewan was

to retrace our steps around the head of the lakes and go down the western side. This entailed deep, but not especially troublesome, fording, if the horses had had sense enough to keep to the crossings into which they were headed.

Among the animals which thought they knew a better way was the young mare carrying the salt and sugar. She was rolled head under at the little riffle below the ford and was carried down a few hundred feet before she pawed on to solid footing.

The venturesome filly trotted jauntily out, smeared herself with muck by a roll in the nearest mudhole, then galloped on to set the pace for the pack train the rest of the morning.

The reason for the culprit's blitheness of spirit became known when we unpacked at the end of the afternoon. What with leakage of brine from the salt sacks and syrup from the sugar, Nelly had reduced the weight of her pack at the rate of something better than 10 pounds to the mile all the way to the Saskatchewan.



Photograph by Lewis R. Freeman

SHOEING A REFRACTORY HORSE

This must have been the sort of thing which Soapy had in mind when he spoke of letting Nature take its course in the matter of reducing packs.

To do the veteran justice, he seemed as much upset as any of us over the loss, and even promised to punish a possible repetition of the offense by giving Nelly the dried fruit and dehydrated vegetables to carry when we took up the trail again. This he forgot to do, however, much to our ultimate sorrow.

We came down to the Saskatchewan a mile above the point where it receives the Mistaya in the shadow of pinnacled Mount Murchison and just below the junction of the North Fork and Howse River.

Although not more than 15 to 25 miles from its principal glacial sources, it is already a mighty river, varying in width from 500 yards to half a mile, according to the stage.

Nothing allows a river to accumulate volume so rapidly as a series of great glacial reservoirs tapped by its headwaters. In few, if any, of the great mountain systems of the world are these ice feeders located so favorably for the rapid augmentation of flow as in the Columbia Ice Field region.

The Athabaska, flowing north from the Columbia Ice Field, probably has an even

Photograph by Lewis R. Freeman

BUSTER AND HIS MASTER WITH THE RADIO

It was discovered, after reaching the Columbia Ice Field, that the numerous hard knocks and baths in icy streams to which the radio outfit had been subjected had not put the portable set out of commission. From that time it proved a constant source of entertainment, and the party even attempted dog and man power in order to provide gentler transportation for the receiving set when negotiating bad stretches of ice (see text, page 435).

greater volume in its upper reaches than has the Saskatchewan. On the other hand, the drainage to the Columbia, by the Wood and Bush rivers, is much smaller.

Working cautiously from bar to bar and covering perhaps 700 yards of quick-flowing, but not dangerous, water, we reached the north bank without swimming the horses or seriously wetting a pack.

Camp was pitched in the timber at a magnificent point of vantage just below the mouth of the North Fork. Rotting tepee poles, the bent willow frames of steam bathhouses, and deep layers of musty hair scraped by tanners from hides of deer, elk, and moose indicated that the site was once an Indian rendezvous.

ANCIENT INDIAN HUNTING TRAILS LEAD TO THE ICE CAPS OF THE DIVIDE

The Indians of the plains never established permanent habitations far inside the Rockies. That they hunted the vast system to the very rim of the ice caps of the Continental Divide, however, is shown by their long-disused trails, which we

Photograph by Byron Harmon

THE CAMP AT TIMBER LINE UNDER MOUNT ATHABASKA

Here the party spent four days, resting the horses and photographing Athabaska Glacier. Note the radio aërial. Interesting programs came in at this point from broadcasting stations in many parts of the United States.

found on every pass and often far down into the timber.

Never breaking down the earth save by the soft pat of moccasins, or by the pressure of unshod hoofs, and rarely, if ever, cutting out timber, fallen or standing, these old hunting parties still left behind them fragments of trails that could be improved only by liberal use of ax and pick. Their grades are invariably as favorable as the topography permits.

Not satisfied either with the lighting or backgrounds for his original motion picture of the pack train crossing the Saskatchewan, Harmon decided to wait over and make another under better conditions. Two warm, cloudy days were unfavorable for pictures, but started one of the heaviest late-summer freshets that the Rockies have known in many years.

The river, fed from its many melting glaciers, rose two feet and probably more than doubled in volume, when the third day brought bright skies and a flood of

Photograph by Byron Harmon

BUSTER RIDING A PACK TO SAVE HIS SORE FEET

hot sunshine. Since the crossing was selected for pictorial possibilities rather than for its facilities as a ford, it was evident at the outset that we were in for a lively time in taking the pack train over the swollen river. Dummy packs of canvas-wrapped fir boughs were substituted for boxes, bed rolls, and regular camp equipment. This plan had the double advantage of giving the horses lighter loads and of effectually precluding possibility of additional soaking of outfit and provisions.

THE PACK TRAIN IS FILMED IN A SWOLLEN RIVER

The river had risen so high that Harmon and La Casse succeeded only on the second attempt in crossing with the movie outfit at the broad, shallow ford which we had waded with so little trouble three days previously. They set up the camera on a high bench on the south bank, just above a point where almost the entire flow of the Saskatchewan was concentrated into a single 200-yard-wide channel, and signaled for us to come on with the pack train.

Soapy led the way; Baptie and I urged on the huddled, reluctant horses from the rear. Buster, our collie-husky cross-breed, rode one of the packs. Tip, our Indian mongrel, had funked a similar seat; so I carried him under my free arm.

Soapy's mare was swimming the moment she stepped off the gravel bar along the shore; likewise the rest of the animals, as they followed suit. Several were ducked head-under as they lost their footing, to come up sputtering and wild-eyed, each eager to climb to safety on the back of its neighbor.

Packs were badly bumped and jostled, with two or three bundles of young Christmas trees breaking loose and floating downstream in mute vindication of our wisdom in substituting them for the sugar and the radio.

Buster was knocked from his seat at the first souse; but Tip, clinging with almost catlike grip, kept hooked on to the crook of my arm.

Orientating themselves as the shock of the first plunge passed, the horses spread out and lunged in the wake of the leader. Soapy was trying hard to keep his mount swimming at an angle that would carry

Photograph by Byron Harmon

FORDING THE SUNWAPTA

In the Sunwapta Valley the pack train encountered a sea of glacial mud which proved far more difficult to negotiate than the river itself.

her out at the only practicable landing on the cut and broken bank opposite.

The swift current was setting him down much faster than had been calculated. Seeing that the only alternatives were to make the landing, or to go on to, and possibly under, a pile of drift logs blocking the entrance of a side channel opening just below, he slid off backward, and towed by the tail to give his horse a better chance. Still failing to close with the landing fast enough, Soapy wisely headed his horse back to midstream, so as to give the drift a wide berth. He then made for a bar where the river broadened and shallowed below.

I would have done better to follow Soapy's lead while there was time and room to avoid the treacherous bank; but with my powerful mount, Jerry, swimming strongly and with plenty of reserve strength, I was reluctant to forego the chance to make the landing as prearranged, and so keep all the pack animals that would follow as near the camera as possible.

We made the bank, but too far down by a scant yard or two. The caving earth broke away under pawing hoofs, and both Jerry and I were well doused when we tumbled back into the icy current.

The shifty Tip, sensing his chance, jumped at exactly the right moment, landing on dry ground with an equally dry hide.

CURRENT SWEEPS MEN AND HORSES AGAINST LOG JAM

I slipped clear of the saddle to give Jerry a better chance to recover his balance, but climbed back with alacrity. The immediately adjacent waters were filled with floundering and more or less upended pack horses. All were in difficulties similar to those of Jerry and myself, and for the same reason.

The next moment the whole mob of us was slapped by the 10-mile current against the jutting jam of logs.

With each horse trying to climb over his wallowing, snorting neighbor, it was exceptionally good luck that no participants in the mêlée were much banged up.

There was not enough water drawing beneath the logs to create a dangerous undersuck, nor yet enough flowing over them to tempt the horses to risk broken legs by climbing the obstruction.

Finally, the current got sufficiently behind the milling mob to roll it around the end of the barrier, where there was straight swimming to the bar below.

Seeing first-class "action" going to waste under the high bank, Harmon brought his long-distance shot to a sudden end and rushed down for a close-up. Setting up with feverish haste, he was just in time for the finale at the log jam.

There was a twinkle in his eye when, a few minutes later, he sauntered up to where we were drying out by doing an Indian dance round a log fire and casually asked if we'd mind doing the first part of that close-up again! Soapy replied with a guffaw on behalf of the horses, while I made similar response on my own account.

We did make the return by swimming the same channel, however, but starting high enough up to work well clear of the cut bank and the jutting log pile.

A BEAR AND HER CUBS FACE THE CAMERA

While filming the rough, steep gorge of the North Fork the following morning, we obtained one of our best wild-animal shots. A black bear was playing with her two cubs on a patch of sunlit rocks. After surreptitiously photographing their amusing antics from a comfortable distance with his long-focus lens, Harmon suggested an interesting variation of action. I was to close in and make our presence known by throwing a stone or giving a lusty yell.

I chose the latter as the less belligerent way of creating the desired diversion.

The effect of my Apache war whoop, delivered from cupped hands not more than 50 feet from three pairs of sharp, back-laid ears, was all that could have been desired. Without even looking in the direction of the blast, that capable old mother swatted swiftly at a cub with each paw, then herded them pell-mell up a near-by jack pine.

The instant the hindmost of the precious pair was clear of the ground, round she wheeled and came charging back to settle with the enemy. Full tilt she came to the brink of the gorge, where, perforce, she came to an abrupt and sliding stop.

That 50-foot-wide canyon of the North Fork was the keystone of our strategy. We and the camera were on one side, the temperamental mother bruin on the other. The film was a complete success, even showing the cubs peeking round their sheltering tree to watch their mother shake an admonitory paw at us.

THE SASKATCHEWAN FLOODS THE FLATS

A Chinook wind, warm and soft as new milk, had been playing upon the ice fields to the west and north for three days, followed by hot, brilliant sunshine pouring from cloudless skies, on the morning we resumed our journey.

There was a diamond glitter on the pinnacles of Forbes and the serrated line of its sister peaks along the Continental Divide. Near and far every mountain was streaked with the "downward smoke" of waterfalls, shimmering brocades of jeweled silk in the sunshine, flutters of wind-blown carded wool in the shadows.

The Saskatchewan was out of its banks at the forks, spreading over the flats and encroaching upon the high mark of the spring rise. In the narrow gorge of the North Fork, where the water was up from 20 to 25 feet in three days, what had been cascades and abrupt falls of six feet and more were completely wiped out by a solid white stretch of tumbling torrent (see page 388).

As long as the horses could find footing on the rocky lower slopes of the long massif of Mount Wilson, which bulwarks the North Fork to the east, we were able to avoid the spreading floods on the flats. When talus and snowslide débris finally presented unsurmountable barriers, there was no alternative but to push on up the valley along the inundated bottoms.

Then we learned the meaning of real water trouble. Although successful in avoiding a complete ford of the main river, there were endless networks of back channels to be passed, many deep and steep-banked. With the surging water practically opaque, there was no telling whether the next step would land a horse to his fetlocks or up to his mane.

Photograph by Lewis R. Freeman

FORDING THE ATHABASKA RIVER

Some of the meltage of the Columbia Ice Field reaches the Arctic Ocean through this river, which flows into Lake Athabaska, thence into Slave River, Great Slave Lake, and the Mackenzie River (see text, page 379).

Photograph by Byron Harmon

A DEEP SWIMMING FORD AT THE FORKS OF THE SASKATCHEWAN

In order to get a graphic motion picture of the expedition's pack train crossing this river, the party remained in camp on its banks for several days. In the meantime the waters rose, and when the film was made the swift current not only provided the setting for a thrilling picture, but almost brought the outfit to grief (see text, page 406).

Photograph by Byron Harmon

THE EXPEDITION'S CAMP NEAR THE HEAD OF MALIGNE LAKE, ALBERTA, CANADA (SEE PAGE 446)

Photograph by Byron Harmon

CLIMBING UP THROUGH FOUR FEET OF SNOW TO JONAS PASS (SEE PAGE 446)

Photograph by Lewis R. Freeman

BLACKMONKS AND CHABA PEAK FROM THE BANKS OF THE ATHABASKA

From the mouth of the Chaba the party followed the course of the Athabaska River to Jasper, where additional provisions and winter clothing were obtained for the return journey to Banff.

Photograph by Lewis R. Freeman

A WATERFALL FED BY A STREAM WHICH GUSHES FROM A MOUNTAIN PASSED ON THE CLIMB TO CASTLEGUARD VALLEY

"In my experience I can recall no spring to compare with it in volume, unless it be the one in the Anti-Lebanon which feeds the river flowing through Damascus" (see text, page 429).

Photograph by Lewis R. Freeman

A SNOW-CLAD HEIGHT NEAR THE JUNCTION OF THE CHABA AND THE ATHABASKA RIVERS

Soon after leaving this point the party picked up a well-cut-out trail, once the transcontinental path followed by the Hudson's Bay Company traders.

Photograph by Lewis R. Freeman

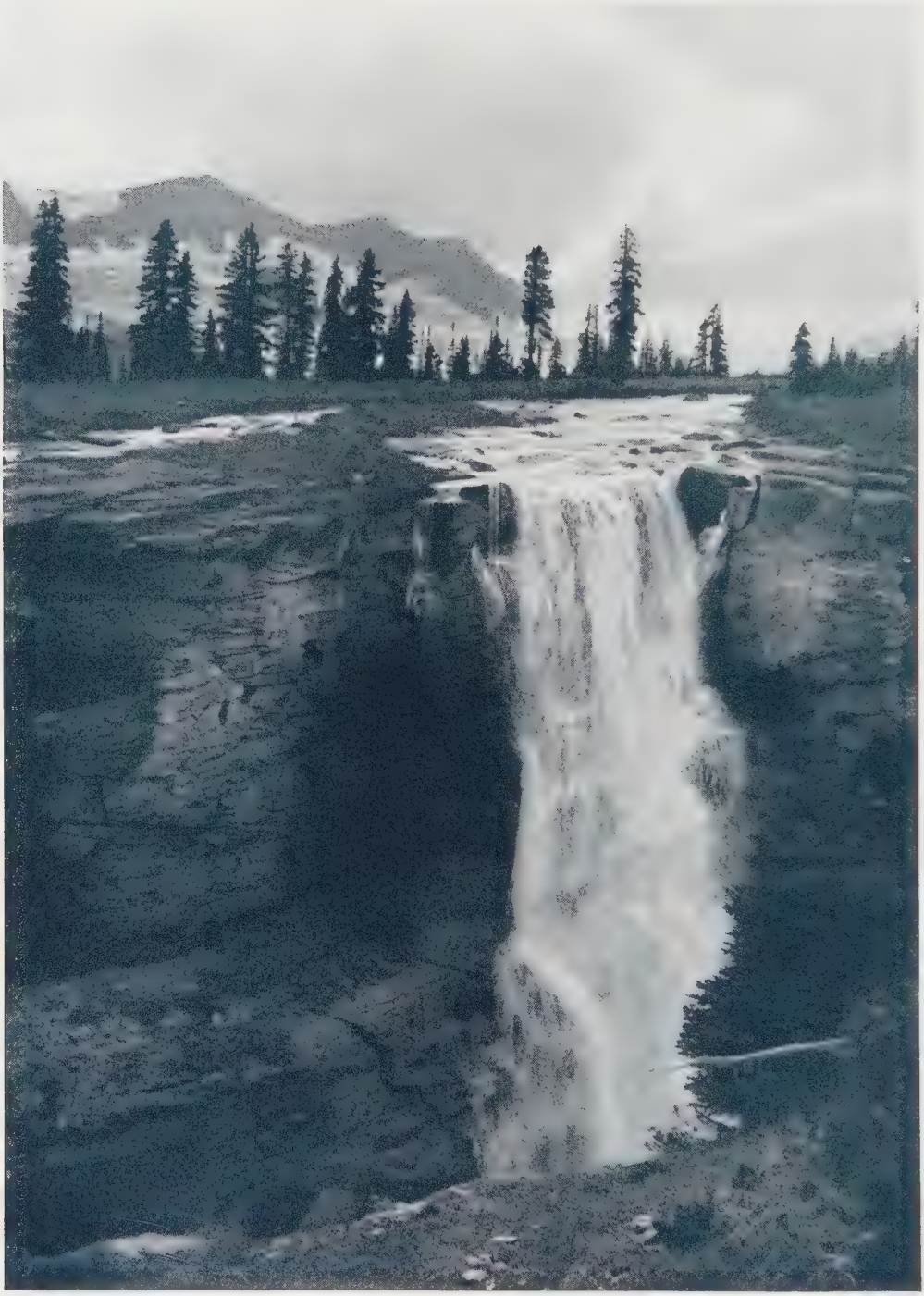
THE SNOWY WALL SURROUNDING FORTRESS LAKE

Early traders and trappers tried to establish a new route from Hudson Bay to the Columbia River by way of the Chaba branch of the Athabaska and the silver gorge of this beautiful lake, but they failed.

Photograph by Byron Harmon

ROUGH GOING ACROSS SHALLOW CREVASSES IN SASKATCHEWAN GLACIER

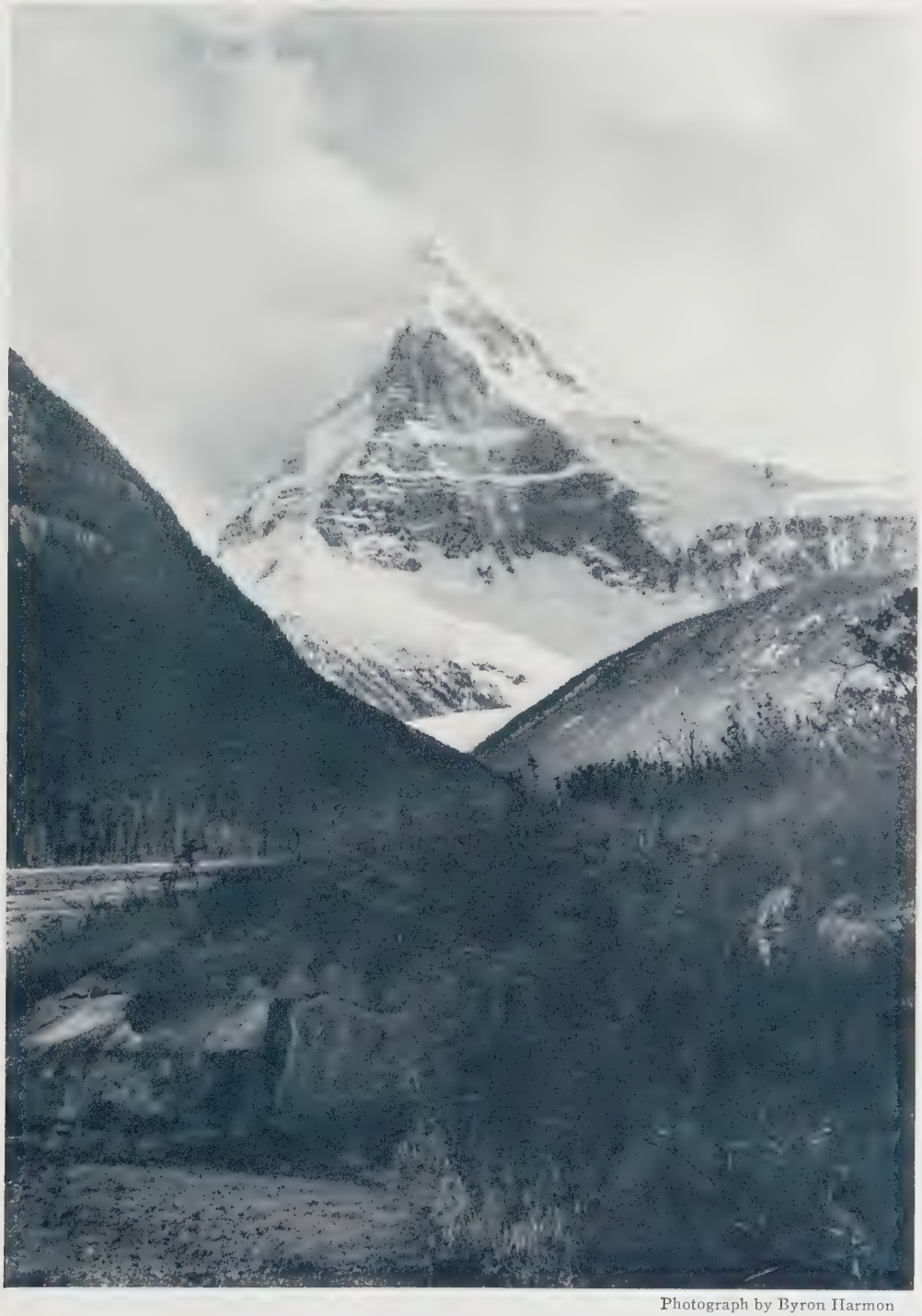
Winding, twisting, and doubling back on the track from time to time, the pack train was slowly worked across the ice. Occasionally, yawning cracks opened into the blue-green depths and turned the party aside. The surface of the glacier proved to be unexpectedly firm underfoot, however (see text, page 437).



Photograph by Lewis R. Freeman

CASTLEGUARD FALLS

The steep, slippery, deadfall-choked trail from Alexandra River up to Castleguard Valley had been blazed by the Canadian Interprovincial Boundary surveyors. This cataract was just below the camp of the Harmon-Freeman party (see text, page 429).



Photograph by Byron Harmon

THE SHARP PINNACLE OF MOUNT COLUMBIA AS SEEN FROM THE NORTH

The members of the expedition waited eight days and endured a 96-hour blizzard, hoping for suitable light conditions under which to photograph this mist-robed mountain. Finally, the clouds parted and for 40 minutes the conditions were ideal (see text, page 443).

Photograph by Lewis R. Freeman

LOOKING DOWN BOW LAKE

"We pushed through a forest of fine old spruce to a protected and beautiful camp site a few hundred yards back from the north side of the lake, with Bow Glacier, rosy-pink in the sunset glow, reared against the sky line" (see text, page 395, and illustration, page 378).

Photograph by Lewis R. Freeman

A LAKE NEAR THE HEAD OF SASKATCHEWAN GLACIER

The only approach to the surface of the glacier was across broken rock ridges above the head of this lake. It was rough going, especially where the rock and ice were mixed (see text, page 437).

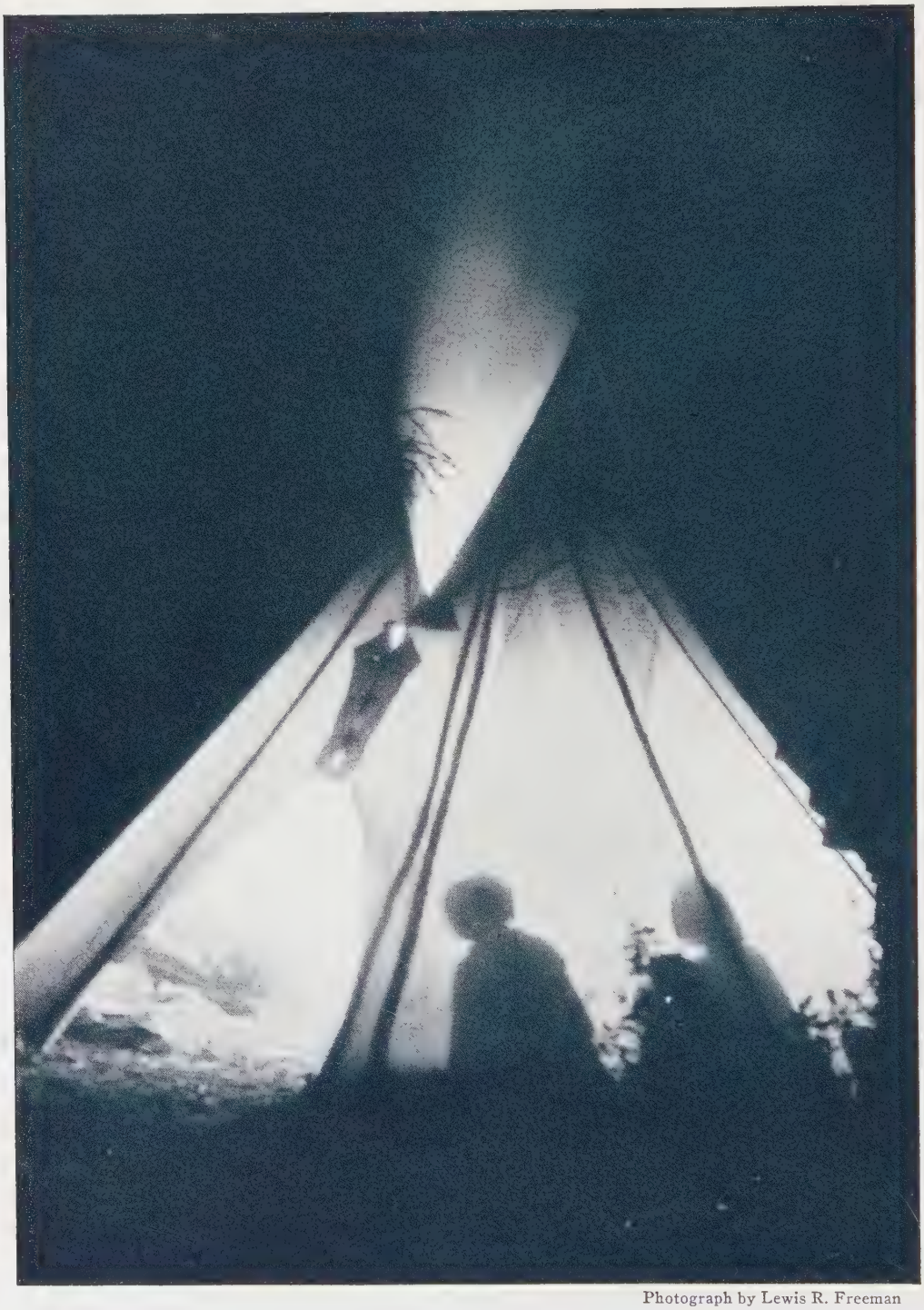
Photograph by Lewis R. Freeman

CLIMBING TO WHITERABBIT PASS

Photograph by Byron Harmon

ON THE SLOPES OF CASTLEGUARD, LOOKING SOUTH TO MOUNT LYELL AND THE MAIN CHAIN OF THE CANADIAN ROCKIES

The view from Castleguard is one of the great mountain panoramas of the world. Many of the finest peaks of the Canadian Rockies are notched into the view (see text, page 433).



Photograph by Lewis R. Freeman

FLASHLIGHT OF A TEPEE AT NIGHT

The flash has been discharged within the tent, casting the shadows of the occupants upon the canvas wall.

Here we paid the penalty for false courage bred in the horses as a consequence of our little movie exhibition with dummy packs.

HORSES CURE TRAIL TROUBLES BY WATER TREATMENT

Up to that time, nearly all the animals had been extremely nervous about tackling a deep ford; afterwards they had altogether too much confidence. Let the road blazed for them be rocky, boggy, or blocked with deadfalls, and forthwith the leading spirits would bolt toward supposedly easier going in the nearest water, be it the boulder bed of a cascade or the cut bank of a slough.

After a few days we came to understand and to anticipate these outbreaks toward the new freedom; but that first morning on the North Fork we were caught unprepared.

Without blinking an eye, Nelly, the sugar-and-salt horse, walked off a bank of glacial silt that was caving and receding before the attack of the gray-green torrent of the main river. Rolled over and whisked away in an instant, she came up with a blithe snort and started swimming straight for Hudson Bay.

With the 12-mile current and her purposeful pawing, she traveled at five times the speed at which we could force our horses through the brush and mud of the flooded flats, and was out of sight around the next bend before we were well started.

Of course, she had to strike bottom in time, and it was by the best of luck that the intercepting gravel bar, a quarter of a mile below, chanced to run out from our side of the river. Even here the perverse filly was of two minds about rejoining us, stoutly declining to move a step shoreward until La Casse waded out to bring her back.

All the sugar and salt salvaged from this baptism was in the shape of dirty brown chunks. The indurated slabs left after the containing sacks had been dried all night by the fire were reduced with an ax.

Several other packs were badly soaked by plunges into deep water, due to the newborn mania of the horses to cure their trail troubles by hydropathic treatment.

The radio was the worst casualty. It underwent complete submergence when the horse carrying it stepped into the river and was swept down under the horizontal trunks of several undermined pine trees before he found a place to climb out.

As the radio, due to previous disintegrative bangings and bumpings, was already rated a total loss, we were less concerned over its wetting than about that of the sugar and salt. It was now inevitable that even the miserable remnants of the latter must be exhausted weeks before our supply could be replenished.

We pitched camp opposite the mouth of the Alexandra late in the afternoon, having made about eight miles. Several horses were so played out that they were unable to stand until their packs were removed.

SOAPY LEAVES A NOTE

The human elements of the party were holding up fairly well physically, but the mental atmosphere of the camp was well reflected in a note which Soapy wrote, to be left on a forked stick for a guide who was expected to follow later with a hunting party. Slightly expurgated, this missive concluded as follows:

> "If you need any sugar or salt, dip it out of the Saskatch. Nine-tenths of ours is already in the drink and the rest most likely goes to-morrow. If you see any horseshoes floating downstream, look under them for my cayuses. Deep-water navigation by pack train ain't what it's cracked up to be."

Another humid night, succeeded by a clear, hot day, brought still higher water. We crossed the score of scattering channels of the North Fork without trouble, only to find the whole lower flat of the Alexandra turned into one unbroken lake.

There was no way of avoiding it, save by heading the pack train up into the thick-growing timber of the very steep slope to the north. Constantly reslinging packs and rounding up the scattered animals, we had made scarcely more than a mile by early afternoon. To reach the nearest practicable camping ground before dark, therefore, left no other alternative but to drop down to the flooded flats.

These were still completely covered where we pushed out on them, but with

Photograph by Lewis R. Freeman

FORDING THE SUNWAPTA WITH THE RIM OF THE COLUMBIA ICE FIELD ON THE SKY LINE

much less water here than below. Splashing on as best we could, a point was finally reached where there were occasional stretches of solid going between the long, deep fords of the quickening river.

We unpacked the jaded horses at 6 o'clock on the rough, sloping boulder fan of a glacial torrent pouring down to the Alexandra from an ice field to the south.

THE TIRED HORSES LIE DOWN WITH THEIR PACKS

The next day the river was swifter and narrower, with broad, hard gravel bars between the winding channels. It was much better going than on the previous day, but the horses, weak from overwork and underfeeding, had trouble at the constantly recurring fords.

At the end of three miles, all were straggling badly, with several persisting in lying down with their packs. When another mile brought us to a good camping ground not far below the Alexandra Glacier, we were glad to stop.

Following a night in better grass, the horses were stronger—a fortunate circumstance in view of the fact that the final stage of our climb to the level of the Columbia Ice Field promised to be arduous.

A mile and a half over a densely timbered ridge brought us back to the main, or north, fork of the Alexandra, usually called Castleguard River. Flowing in a

Photograph by Lewis R. Freeman

ATHABASKA GLACIER FROM WILCOX PASS (SEE TEXT, PAGE 442)

half-canyoned valley, its declivity was such that gravel and mud had been carried down to the flats, leaving behind only a channel choked with boulders, many of unstable equilibrium.

Torrential water tumbling over boulders makes almost prohibitive fording conditions. A horse may break a leg in the wink of an eye, while footing once lost may be quite impossible to regain.

We took every possible precaution in the two crossings we had to make and felt ourselves fortunate that nothing worse than wet packs resulted. Several horses were carried down 100 feet or more at both fords, but luckily found sloping bars upon which to clamber out.

These, with two or three crossings of the Sunwapta and Athabaska on the Arctic side of the Divide, were the most dangerous fords we had.

UNDER THE EAVES OF THE CONTINENTAL ROOFTREE

We were now practically at the fountainhead of one of the main sources of the Saskatchewan—under the very drip of the eaves of the continental rooftree. To the east was the rocky summit of Mount Saskatchewan. To the south the peaks of the Lyell massif glittered in solid, unbroken white. To the west, almost directly above us, towered Alexandra, Spring-Rice, and Bryce. To the north were Athabaska, the Twins, and Columbia, but cut off from our vision at

Photograph by Lewis R. Freeman

MIDWAY UP THE ATHABASKA GLACIER

the moment by the more imminent loom of the southern bulwarks of the great Columbia Ice Field.

Most of these peaks were more than 11,000 feet in height, two of them more than 12,000.

We had penetrated to the very heart of a kingdom of ice and snow, on a day when all of it seemed to be melting. The glaciers spewed out raging torrents of savage power, and besides the streams from melting ice and snow, the mountain sides were streaked with rivulets from countless underground springs.

Many of these subterranean flows were of great volume, notably one which fed a splendid waterfall immediately below the point where we left the Alexandra for the steep climb to Castleguard Valley. The stream from this fine cataract seemed to furnish more than half the flow of the whole river. Yet our explorations later revealed that all of it gushed from the mountain side not more than 200 feet above the brink of the fall.

I am inclined to think that 1,500 second-feet would be an underestimate of the flow at the time of our visit. In my own experience I can recall no spring to compare with it in volume, unless it be

Photograph by Lewis R. Freeman

ON THE EDGE OF A CREVASSE IN THE ATHABASKA GLACIER

the one in the Anti-Lebanon Mountains which feeds the river flowing through Damascus, and which tradition claims sprang originally from a footprint of Abraham.

The trail from the river to the Castleguard Valley was blazed by the Interprovincial Boundary surveyors and has been used several times since by mountain-climbing parties. Steep, slippery, and deadfall-choked though it was, the going was infinitely preferable to the punishing grind in mud and water we had endured since leaving the forks of the Saskatchewan.

And the valley itself—a thousand acres of mountain meadow with perpetual ice on three sides—was a near-paradise.

Although at the verge of timber line, stunted but close-growing fir and spruce provided wood, tepee poles, and shelter from the wind. A streamlet flowed past the cook-tent door. Knee-deep grass up the valley promised a feast for our half-starved horses.

Nothing but the smoke of our own camp fire could cut us off from the pinnacles of Spring-Rice and Bryce, notching the sky line to the west, or the buttressed heights of Castleguard, lone sentinel of the Columbia Ice Field to the north. A 20-foot cascade on the river above the camp and a 100-foot sheer fall just below were the crowning touches in a picture etched deep on the tablets of memory (see pages 394 and 414).

Our work at this camp was to film the superb panorama from the summit of

Photograph by Lewis R. Freeman

LOOKING UP THE CHABA VALLEY TO THE CONTINENTAL DIVIDE

The party enjoyed a rest of three days at this camp, where the horses found good grazing and recuperated from the hardships of the eight-days stay near the glacial source of the Athabaska (see text, page 446).

Photograph by Lewis R. Freeman

LOOKING ACROSS FORTRESS LAKE TO CHABA PEAK

From the camp at the Chaba (see opposite page) a hurried side trip was made to this body of water, which sits on the Continental Divide and drains two ways.

Photograph by Lewis R. Freeman

A PENINSULA ABOVE THE NARROWS OF MALIGNE LAKE, ALBERTA

Here three days were spent in October, and when the return journey was resumed heavy snow was encountered in the passes.

Castleguard. This striking peak, though little more than 10,000 feet in height, is so located as to offer a unique vantage for viewing or photographing the great Columbia *mer de glace,* with the stupendous walls of mountains surrounding it.

We were anxious for at least two hours on the summit during which there would be not only local sunshine, but a clear sky line of peaks in every direction. Such an ideal day might occur not over once or twice in a summer, but we were prepared to wait for the nearest possible approximation to it.

The sudden break-up of the humid Chinook spell, followed by a violent snowstorm of almost blizzard magnitude the day after our arrival, seemed to point to a long, tedious wait. Then another kaleidoscopic shift brought just the day we were looking for, or at least a morning which promised to develop into such a day.

As practically the whole 3,000 feet of climbing was over ice or snow, there was no chance to use the horses.

For a real mountain-climbing party, the ascent of Castleguard is comparatively easy. Harmon and La Casse were fairly experienced, but the packers and I were novices. Our heavy movie camera and tripod, four still cameras, and much incidental impedimenta averaged for each of the five of us possibly two or three times the weight ordinarily carried by the alpinist.

And so we made a hard, tiring pull of it, with many halts to regain breath and to massage incipient cramps out of knotting muscles. The last 1,000 feet were the steepest, and steps had to be cut with an ice ax for most of the distance.

Personally, I was extremely glad of the sustaining pressure of a rope during the precarious clamber up a "chimney" just below the summit.

THE GREAT PANORAMA FROM MOUNT CASTLEGUARD

Possibly lacking the sheer, breath-taking wonder of the first sight of Kinchinjunga's snows from Darjeeling, the view from the summit of Castleguard is still one of the great mountain panoramas of the world. Set on the southern rim of the Columbia Ice Field, with no other peak encroaching on its domain for many miles, there are no masking barriers close at hand to cut off the view in any direction.

Not only are many of the finest peaks of the Canadian Rockies system notched into the splendid panorama, but some of the Selkirks and Gold Mountains, far beyond the purple-shadowed depths that mark the great gorge of the Columbia River.

The first white man to see the Columbia Ice Field was J. Norman Collie, in 1898. It was he who named Bryce Peak, after the late British Ambassador to the United States.

This is the dominating peak in the panorama unfolding from most of the Columbia Ice Field. Mount Columbia, with an altitude of 12,294 feet, is the highest summit in this region of the Rockies, and ranks second only to Robson in the Canadian system. Seen from anywhere to the south, however, it appears comparatively insignificant, probably due to the foreshortening of the long slope up from the great ice field. This rounded hummock of snow can hardly be recognized as the slender Matterhornlike pinnacle we were later at such trouble to photograph from the head of the Athabaska (see text, page 442, and illustration, page 419).

Presenting even more contrasted views, as seen from the south and north, is the Snow Dome. Although the altitude of this remarkable eminence is 11,340 feet, the slope to its summit from the Columbia Ice Field looks gradual and smooth enough to be navigated by an automobile; yet the northeast side is an almost sheer cliff of 5,000 feet to the upper flats of the Sunwapta.

It is the Snow Dome which forms the hydrographic apex of the drainage of the Columbia, Athabaska, and Saskatchewan.

The deep purple-indigo dome of the sky looked clear enough to last a week, as we struggled up to the top of Castleguard. Harmon, however, was too experienced in Rocky Mountain summer weather to presume upon momentary fairness. Seeing a vaporous boil of dark clouds beginning to surge against the barriers above Columbia's gorge, he set up his cameras and cranked off film in feverish haste.

Photograph by Byron Harmon

THE PACK TRAIN CLIMBING UP TO JONAS PASS

In the lower valleys the snow was from six inches to two feet deep; in ravines the party had to break its way through drifts of from four to six feet.

Two complete panoramas were made—one with and one without a filter on the lens. Photographs of individual peaks were also made with the telephoto lens and "slow-turn" exposures on the progress of the gathering clouds across the face of Mount Bryce. A round of shots with the various still cameras gave us everything we came for, and under almost perfect conditions of light and air.

We finished in the nick of time. Before the cameras were packed, the vanguard of the mists was pushing up the slopes from the west, to come swarming over the top as the last man took his place on the rope and we started to descend.

Going down, as is usually the case with a novice, I found more trying than climbing up. Two or three times, when my dangling heels refused to find holds in the chimney, the rope was more than an ornament.

THE COOK FALLS INTO A CREVASSE

Hardly had we kicked free of the rope at the foot of the steepest pitch when La Casse, loping on ahead with the dogs over apparently unbroken snow, dropped completely out of sight. He reappeared an instant later, having caught one foot on a ledge just under the brink of the crevasse.

The latter, thinly but entirely bridged

Photograph by Byron Harmon

FACING WIND AND BLOWN SNOW ON CASCADE PASS

by the drift from the late snowfall, was of great depth, its smooth green walls disappearing from sight far below the length of our rope.

In Dr. J. Monroe Thorington's interesting record concerning his ascents of a number of mountains of the Columbia Ice Field in 1923, there is this concluding sentence in his account of the return from Castleguard:

"It was a day of enjoyment for all, although the disappearance of our cook in a small crevasse frightened us badly."

By an interesting coincidence, it was not only the same cook, but almost certainly the same crevasse. As old Soapy commented: "Seems like there's two things cooks is most always pretty near losing—their tempers and their hides!"

As a matter of fact, La Casse was not only extremely good-tempered, but also probably the best mountain man of the party.

THE RADIO FURNISHES ENTERTAINMENT AND NEWS

While overhauling and shaking down the outfit in preparation for the grind across the ice field, we discovered that not all the bangings and soakings to which it had been exposed had seriously affected the radio. Although there was something loose in every tube, not one refused to light when connected with the batteries.

This encouraged us to string up the aërial hastily, with the astonishing result that stations as far apart as Oakland and Pittsburgh came in very strongly that afternoon and evening.

A windstorm tore down a limb of a tree supporting the aërial and put a premature end to this first trial. But we had heard enough to know the radio was going to prove a very interesting companion.

From that time on, we protected it much more carefully, even attempting dog and man power in order to provide gentler transportation for it over several bad stretches of ice (see page 404).

Our care was well rewarded. For the next six weeks there was hardly a night in which we did not get at will several of the strongest major stations of the country, with odds and ends of minor ones coming in unexpectedly. We heard a complete opera rehearsal in San Francisco, from the Oakland station; most of the

Photograph by Lewis R. Freeman

LOOKING DOWN THE VALLEY OF JONAS CREEK TO SUNWAPTA FROM THE JONAS-POBOKTAN DIVIDE

Wills-Firpo fight, rebroadcast blow by blow from the ringside by Hastings, Nebraska; and midnight programs of song and jazz from Pittsburgh on many occasions.

The regular daily-news summary, which came best from Oakland and Vancouver, was the greatest treat of all.

A carrier-pigeon letter, sent out by Banff to an editor in San Francisco, was read back to me, with a reply, from the powerful Oakland station a week later.

Our purpose in traversing the length of the Saskatchewan Glacier with the pack train was twofold. That route would save from 40 to 50 miles of flooded flats in getting around to the north side of the Columbia Ice Field; it would also give us a far more intimate glimpse of the great ice field itself.

Heavy as the possible penalty of failure might be, the chance was worth taking on either score. We were the more sanguine of success since this same route had been traversed the previous year by the Thorington party.

La Casse, who had been on this initial venture, undertaken in June, thought we would find conditions less difficult in September. This was on the sound theory that, with most of the winter's snow gone at the later date, there would be firmer footing on the solid ice of the glacier, with less chance of stumbling into thinly covered crevasses.

THE DIFFICULT APPROACH TO THE SASKATCHEWAN GLACIER

Anticipating difficulties on the ice, we broke camp and started up the valley very early on the morning of September 6. An hour and a half of steady climbing took us over the divide at an elevation of about 1,000 feet above timber line. A mile almost on a level, with a slight descent at the end, brought us out by a beautiful little ice-walled lake at the side of the glacier.

The easiest point to reach the ice—a rounded depression at the foot of the lake—proved impracti-

cable because of a broad swath of unfathomable glacial mud.

The only approach was across the broken rock ridges above the head of the lake, where we had already found evidences of the passage of the previous party. It was terribly rough going, especially where the ice and rock were mixed in a vile conglomerate; but the pack train was worked across without serious trouble.

At the edge of the ice the horses were tied head to tail in groups of three or four, each group to be led by a man on foot. This gave more satisfactory control and prevented straying when out among the open crevasses.

La Casse, with one group, took the lead; Baptie, Soapy, and I followed with the other three. Harmon, leading only the horse with the motion-picture camera, scouted on a roving commission.

The horses, although in fine fettle after five days' feasting among the juicy mountain-meadow grasses, took the work seriously and showed little desire to bolt or hang back. Plainly, the strangeness of their surroundings and unstable footing had a sobering effect.

The day was even more nearly perfect for photographic work than that on which we had ascended Castleguard. There was a clear vault of indigo sky overhead, with the west banked full of rolling cumulus clouds, which gave all the effect of an approaching storm, but without the threat.

The rims of the hanging glaciers high up on the mountains to left and right were scintillant with reflected sunlight. On all sides the broken surface of the ice field threw tremulous shadows, like those of the waves of a choppy sea (see page 417).

The pictorial possibilities of the traverse so smote upon the artistic spirit of Harmon as to leave him for the moment gasping like a child set down in a candy shop and told to help himself.

THE PACK TRAIN WORKS DOWN THE GLACIER

Winding and twisting, doubling and turning, La Casse slowly worked the pack train out toward the great medial moraine stretching down the middle of the glacier.

Yawning cracks, opening beyond eyescope into the blue-green depths of the ice, repeatedly turned us back; but there was none long enough to block the way completely. Such chances as there were of breaking through, La Casse took by going ahead.

Indescribably rough and slippery, the surface of the ice proved unexpectedly firm underfoot. A horse had its tail or neck sharply stretched now and then, as its mate immediately astern or ahead went down and wallowed at the end of the binding halters. The casualties to packs, however, were less than when working through the mud or in the timber.

The abysmal groans of cracking ice were nerve-wracking to the novice at first, but one steadied to them in time, when they failed to make good their threats of opening up the glacier under one's very feet.

THE HORSES SLIDE TO SAFETY

Doing two or three miles of windings for every one of progress toward the foot of the glacier, the hours slipped swiftly by. We were still a mile from the point where the end of the ice wall broke down to the flats of the Saskatchewan, when a deepening and widening of the crevasses ahead warned us to get the pack train off on to the rocky mountain side to the north.

The only place where it appeared this could be accomplished successfully was a narrow tongue of ice and gravel, running down to the native rock, between two very deep crevasses. The "runway," with the ice breaking sharply away on either side, was about 20 feet wide; the distance down to the rock perhaps 80.

With the slope far too smooth and steep to provide hoofhold, the only really safe way of getting down would have been to unpack the horses, throw them, tie their feet, and lower them on their sides by ropes. An animal was bound to go down somehow, of course, once he was started. The danger was that, floundering in his fright, he might get into one of the crevasses.

Lacking time to resort to the safety-first method, we turned to the only other alternative. This consisted of leading each horse to the edge, starting him

Photograph by Byron Harmon

STRUGGLING UP JONAS CREEK VALLEY A THOUSAND FEET ABOVE TIMBER LINE

For ten days the Columbia Ice Field party did not see the bare earth, except for wind-swept peaks and small patches under thick trees.

down, headfirst, by a rope pulled from below, and trusting to his instinct to keep his center of gravity low by sitting on his haunches and sliding, rather than floundering to a footing.

This succeeded even beyond our hopes. Though all the horses did not have the sense to slide, the three or four that invited rolling by trying to gain their feet kept on going in a straight line, reaching the bottom unhurt.

With a faint trail streaking the rocky mountain wall where the pack train of the previous year's traverse had picked its way, it now seemed that the worst was over. Another hour at the outside would, we thought, bring us to a camp in the flats below the snout.

We took our time in relashing packs for the rough clamber down along the side of the glacier. The mauve shadows of coming night were piling thick in the ice-filled valley by the time we were ready to push on.

A quarter mile of increasingly difficult going brought the head of the pack train to a point where a breaking away of the mountain side above had choked the route with a slide of broken rock, extending as far ahead as one could see. It seemed so impossible to cross, that we turned to the glacier again, in the hope that the ice could be followed at least far enough to get below the rocky barrier.

A way to the glacier over an easy-sloping drift of old snow lent momentary encouragement. But our disappointment was keen when we found ourselves on a patch of ice, hardly 100 yards in diameter, completely encircled by a connecting series of impassable crevasses.

THE PACK TRAIN PUSHES THROUGH A SLIDE OF TILTED ROCK

There was nothing to do but return and try to pass the great rock slide.

The problem was a dual one. The huge, sharp-edged fragments were so set that sliding hoofs went down between them at every other step, and many were poised in so delicate a balance that the least touch was likely to send them bounding down, to start a slide that nothing but the side of the glacier could stop.

I would have been reluctant to venture here on foot; with a pack train it seemed like courting certain disaster.

For an anxious interval at the outset it looked as if calamity were coming to meet us, even before we had made a real start. We were working the animals, one at a time, out on to what seemed the least-threatening line of passage across the broken rock when suddenly the horse carrying the radio tried to find a way of his own, and stepped between two tilted chunks, each larger than himself.

Instantly both closed down upon him, smothering his frantic flounderings in the grip of a vise of stone. It looked like broken legs and crushed ribs, a case beyond all treatment save that of the revolver.

Baptie and La Casse started at once to work away the inclosing rocks. The rest of us stood by to prevent a stampede of the other horses.

Buster and Tip, who had been chasing rock rabbits farther up the slide, charged down, doglike, for the center of disturbance. The flying feet of each started rocks rolling almost simultaneously. Buster scored the first hit when the solid little hunk he had spurned smote Baptie's mount and knocked it sprawling.

RESCUING A HORSE FROM A VISE OF ROCKS

Tip's salvo, with a ton more weight behind the main unit of it, found nothing but the back of my knees to mar the curve of its trajectory. Flicking my legs up into the air, it passed on to crash against the glacier wall, leaving me sitting upright in its cometlike wake of débris.

A missile heavy enough to have shattered a leg of the Colossus of Rhodes had brushed my relaxed anatomy aside, without inflicting more than a few very light bruises.

It took a deal of lifting, hauling, and prying to dislodge the rocks from the imprisoned horse without starting another slide. We had the agreeable surprise, however, of finding the animal practically uninjured, beyond much abrasion of hide.

The stout cedar pack-box containing the radio outfit had taken most of the crushing on one side, while a grub-box had absorbed it on the other.

Our progress across that slide of tilted rocks was glacial in slowness, punishing in severity (see page 402). Horses were down repeatedly, usually with the loss of

Photograph by Lewis R. Freeman

DESCENDING FROM JONAS PASS TO UPPER JONAS CREEK

The hardest traveling on the return trip was experienced in climbing the divide between Poboktan and Jonas creeks.

a pack that had to be rethrown while the whole train waited and fretted.

But foot by foot we worried along, for the first and last time in comparative vocal silence. Even voluble old Soapy bethought himself to choke back the explosive oath that might have set the cumulative air-wave wriggling, to start another hair-balanced rock on the slide above.

Finally we won through to solid footing—a sloping cliff of torn and riven bedrock left exposed by the melting of the glacier. It slanted downward like the roof of a Gothic steeple, while its rough surface tore the unshod hoofs like a rasp.

But there were no more rock slabs to slip between, no more balanced boulders to dislodge.

We hurried to make the most of the dying daylight, and tongues and reatas were unleashed in unison to push on the scurrying, stumbling mob. Fantastic cowboy oaths clove the air like the spatter of shrapnel, and the blended sobbing of winded horses rose in a whistling croon.

A MOOSE STALKS THROUGH AN EXHAUSTED CAMP

Over a half mile of rock, wet with blood from hoofs worn to the quick, we clattered down to the packed white gravel of the flats below the jutting ice-snout. The reflection of the last of the after-

Photograph by Byron Harmon

BREAKING TRAIL THROUGH FIVE FEET OF SNOW ON THE UPPER POBOKTAN

glow was fading from rose pink to cinnamon and dusky olive on the summit of Saskatchewan.

Packs were thrown off at the edge of the timber. Too tired to cut tepee and tent poles in the dark, we rolled to blankets and sleeping bags as soon as a greedily wolfed supper was over. No one but the dogs could have told at what time the big bull moose, whose tracks we found in the morning, stalked straight through the camp on his way to water.

As Soapy was anxious to work the soreness out of the horses by action rather than let them grow stiff in a region where the grass was so poor, we broke camp early next morning and started on the hard, steep climb over the shoulder of Athabaska to the north. The pack train attained the summit of the ridge and began the descent to Nigel Creek at an elevation of about 8,000 feet.

Harmon and I climbed 1,000 feet higher to take a panorama of the surrounding mountains. From a lofty vantage previously utilized by the Boundary Survey, we had a fine view of the remarkable ridge of rock thrown completely across the valley of the North Fork, forming a natural bridge which has never been satisfactorily photographed.

Following the pack train to the valley on the north, we crossed the almost imperceptible divide of Sunwapta Pass, separating the drainage to the Arctic and to the Atlantic, and found camp pitched four miles farther down, almost under the snout of the great Athabaska Glacier.

Here we spent four days, resting the horses, climbing over and photographing the glacier, which vies with that of Saskatchewan for the distinction of being the largest ice tentacle of the great mother glacier.

In spite of violent snowstorms coming up the valley from the Arctic, the radio, still in commission after the terrible banging it had received while crossing the glacier, brought in programs from all parts of Canada and the United States. We were troubled practically not at all with "fade-out," being able to hold the programs of the stronger stations from end to end when desired.

At this camp we first began to take notice of the Pacific coast weather forecasts, broadcast by the powerful KGO station of Oakland. These subsequently

became useful in planning for photographic work and trail movements of a character to be affected by the approach of a storm from the Pacific northwest.

The next point on the Columbia Ice Field which we planned to reach was the head of the Athabaska, immediately under the great peaks of Alberta — the Twins, King Edward, and Columbia. As the crow flies, the distance was not great, but by the only possible route with pack train it was close to 80 miles of flooded valleys.

Because the canyon of the Sunwapta, which heads at the Athabaska Glacier, was impassable for horses, we had to begin the long and circuitous journey by climbing over the lofty Wilcox Pass to the east (see page 427).

We came back to the flats of the Sunwapta below the canyon and encountered a sea of glacial mud far worse than those previously experienced on the Bow, Mistaya and Saskatchewan. Following one serious miring, the whole pack train floundered over the muddy bank into the river, soaking both food and photographic supplies badly. Camp had to be pitched immediately to effect salvage operations.

We left the Sunwapta at the strikingly beautiful falls of the same name, crossed a low divide to the Athabaska, and began the long, tiring pull to its glacial source. There was much hard work in fallen timber, through which we had to push when the valley became too deeply flooded, but nothing comparable for trouble to the mud flats of the middle Sunwapta.

The river was crossed often in its upper reaches, but, with swift water flowing over gravel bottoms, we were compelled to swim the horses only once or twice.

At the end of six days from the head of the Sunwapta we had reached our objective. Camp was pitched under the lee of a timbered island three miles below the base of Columbia peak and glacier and literally at "last grass."

COLUMBIA PEAK IS THE MOST BEAUTIFUL OF THE NORTH AMERICAN ROCKIES

Then followed eight days of futile waiting—an interval in some ways more trying than the worst spells of travel in mud and water. We were vouchsafed one unforgettable view of the slender pinnacle of its summit, suffused in the gold-pink glow of the sun that set on the day of our arrival. Then the most beautiful peak of the whole North American Rockies system settled down to the provocative tactics that had made it a mountain of mystery since the day of its discovery.

One day it was a chaste madonna, raising an adoring face behind a dusky veil that barely revealed a misty outline of its form. Another time it was a dancer, lifting a tantalizing skirt to show dimpling knees twinkling in the froth of billowing chiffon, or poking a coquettishly bared shoulder from behind a masking screen.

This was good "movie stuff," but it was the classic "altogether" that we wanted for the permanent record of the stills.

A FOUR-DAY BLIZZARD SWEEPS DOWN UPON THE CAMP

The half-famished horses were munching willow bark and leaves in place of the grass already gnawed to the roots. Our own salt, sugar, and canned goods were gone, and only a much-reduced ration of bacon, flour, and oatmeal remained. Still we hung on, waiting for our perverse minx of the mountain to exhaust her whimseys and, as Soapy put it, "give us an honest-to-goodness look-see."

As a reward for our patience, what should she do but take the veil completely. With a four-day blizzard from the north reducing the width of our world to a bare 50 feet from the tepee door, we went on waiting, cheered by the wonders of lighting that we told ourselves *had* to come when the proverbial sunshine followed the storm.

But when on the fifth day—the eighth from that of our arrival—the sunshine, passing by the still veiled mountain peak, came only to flood the snowy valley, we gave up the fight and, dejected and beaten, prepared to depart.

With the gaunt, hollow-eyed horses barely able to totter under the depleted loads, the pack train set off down the valley at noon of September 25. The sky was overcast, but Harmon and I, with our saddle animals and the horse packing the cameras, remained behind on the off-chance of an altogether improbable clear-up. Pushing up the valley leisurely

Photograph by Byron Harmon

NEARING THE DIVIDE BETWEEN THE BRAZEAU AND THE CLINE RIVERS

to a sheltered point two miles from the base of the mountain, we ate our lunch and waited for something to happen.

COLUMBIA PEAK DROPS ITS VEIL AT LAST

At 3:30, with a gray barrier of mist still masking the mountains to the southward, it looked as if our only diversion would come from a belligerent bull caribou, who began a series of short, broken rushes in our direction by way of demonstrating his prowess before a small herd of palpably admiring cows.

Then, suddenly and without warning, the veiling clouds fell away like a parted curtain. Mistress Columbia, garbed in a clinging mantle of new-fallen snow, radiant in the calciumlike glow of the low but brilliant afternoon sun, stood bowing, "At your service!" (see page 419).

Both light and setting were beyond anything we had dared hope for—sparkling side-shafts of sunshine, with just enough cloud for background and shadow.

The view lasted for 40 minutes, ever changing but ever beautiful, and in that time we exposed still negatives at the rate of one a minute, besides running 400 feet of movie film. The black rectangles of paper torn from Harmon's film packs were piled up behind his tripods like the brass shells around a hard-pumped machine-gun at the end of a battle.

And a battle this had been, in a sense—one in which, after tasting all the bitterness of defeat, we had snatched a golden victory at the last moment. That, as I think of it now, was the high moment of the trip.

The sooty pall of nimbus, which rolled down from the north to snuff out the radiance streaming over Columbia, pelted us with a spatter of snowflakes. When we had packed the cameras, we rode out of the timber 15 minutes later into the teeth of a baby blizzard.

A TRIP TO HISTORIC FORTRESS LAKE

Fortunately, with heavy mittens, fur caps, and parkas, we were prepared for such an onslaught and we did not have to seek shelter. The horses were a bit at sea until they struck the trail of their mates; then they bent their heads to the gale and plugged doggedly down the valley. With the river at a low stage from the cold, the fords were easy.

The storm ceased just before dark.

Photograph by Byron Harmon

NEAR THE SUMMIT OF WHITERABBIT PASS

On the return journey from Jasper to Banff the photographing party made a wide swing to the east in order to follow the course of the Cline River as far as Whiterabbit Creek, up which the route led over the divide separating it from Ram River (see opposite page).

Photograph by Byron Harmon

IN THE SNOWS OF RAM RIVER

On one of the three days spent in camp at the mouth of the Chaba, to give the horses a chance to graze and recover strength, we made a hurried side trip to historic Fortress Lake. This lovely body of water, which drains both ways from its seat on the Continental Divide, was known to the Hudson's Bay voyageurs and frequently trapped in later years. In the present century it has probably not averaged the visit of an outfit a year.

The timber on the British Columbia side was finer than any other we had seen in the Rockies.

Leaving the mouth of the Chaba on September 29 with light packs, we reached Jasper on the afternoon of October 1. The Athabaska was followed fairly closely all the way, the last two days over a well-cut-out trail. Below the mouth of the Whirlpool, we were on the old transcontinental path of the Hudson's Bay traders.

Some of the cuttings we examined may well have been stumps from one of the very earliest clearings. They looked fully as old as some rotting stumps of great size—doubtless left by the same axes—which had thrilled me in passing the site of Boat Encampment, at the apex of the Big Bend of the Columbia, four years previously.

The successful photographs of Mount Columbia and the head of the Athabaska River completed the picture program as originally laid out. The return with the pack train to Banff was now the main problem.

With the winter's snows already lying deep in the higher valleys and passes, no time was lost in Jasper. We attended to shipping exposed film, reprovisioned, and obtained heavier winter clothes the morning following our arrival, and we were free to take the road again the same afternoon.

Camping three days for pictures at lovely Maligne Lake, we pushed on the morning of October 7, to find heavy snow as soon as we began the ascent to the pass above.

FIGHTING THROUGH SNOW IN 10-BELOW WEATHER

For the next ten days, save for wind-swept peaks and small patches under thick trees, we never saw the bare earth. In the lower valleys snow was from six inches to two feet in depth; on the passes and in drifted ravines we broke our way through from four to six feet. Our hardest fights were over the divide between Poboktan and Jonas creeks, and at the pass between the Brazeau and the Cline.

It was 10 below zero the night before we tackled the former. We had to sleep on boughs without overhead shelter, due to the fact that there were no tepee or tent poles at our timber-line camp. With the horses weak from difficult forage conditions, we were near to failure at both passes, but were fortunate enough finally to win through.

Once down to the Saskatchewan at the mouth of the Cline, we had a well-traveled trail all the way south. More important still, the route led by valleys famous for the finest grazing in all the Rockies. Our most serious worries were over.

With the horses picking up weight and strength all the way, we cantered into Banff on October 24, ten weeks after our departure from Lake Louise. Not one horse had been lost; not one had been permanently lamed, in the whole course of what was probably the roughest continuous pack-train journey made in the Rockies in recent years.

It was a notable achievement for our packers.

Notice of change of address of your GEOGRAPHIC MAGAZINE *should be received in the office of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your June number, the Society should be notified of your new address not later than May first.*

THE LAND OF THE YELLOW LAMA

National Geographic Society Explorer Visits the Strange Kingdom of Muli, Beyond the Likiang Snow Range of Yünnan Province, China

By Joseph F. Rock

Leader of the National Geographic Society's Yünnan Province Expedition, Author of "Banishing the Devil of Disease Among the Nashi," and "Hunting the Chaulmoogra Tree," in the National Geographic Magazine

With Illustrations from Photographs by the Author

WHEN the National Geographic Society's Expedition into Yünnan Province, China, had completed its work extending over a period of two years, I decided to make a dash to Muli and pay a visit to the ruler of that lonely mountain stronghold.

One of the least-known spots in the world is this independent lama kingdom of Muli, or Mili, in the extreme southwest of the Chinese Province of Szechwan (see map, page 450).

Almost nothing has been written about the kingdom and its people, who are known to the Chinese as Hsifan, or Western Barbarians. The Europeans who have passed through during the last 100 years can be counted on the fingers of one hand.

Two years before, I had sent Nashi plant collectors to Muli with a letter to the lama king, announcing my probable arrival within a few weeks. The king, who never leaves his domain, sent me a polite reply, necessitating an 11-day journey by special runner, and asked me not to come. Brigands were too numerous in his district, he said, and it would be impossible for him to give me proper protection.

He stated also that the unruly Tibetan tribe known as the Hsiangcheng, inhabiting the territory of the upper reaches of the Yangtze, came periodically to Muli to rob and plunder. The Hsiangcheng drove off his people's herds of yak, sheep, and horses grazing on the alpine meadows and left his subjects in distress and utter poverty.

I respected the king's wishes and did not visit him at that time, but in January, 1924, just about one month before Chinese New Year, I decided to make my deferred visit before taking the long journey out into the civilized world.

The National Geographic Society's Expedition headquarters were in the Nashi, or Moso, tribal village of Ngulukö, in the district of Likiang, on the slopes of the great Likiang snow range,* which extends from north to south and has three mighty peaks, two of which are 20,000 feet in height.

THE ROAD TO MULI LIES THROUGH GORGES AND OVER MOUNTAINS

These mountains are pierced by the mighty Yangtze, which has cut a trench 13,000 feet deep through a wall of limestone rock crowned with eternal snow, and also makes a great loop which adds several hundred miles to its course. The whole region is a vast conglomeration of peaks and mighty gorges, with very little level ground. The trip from Likiang to Muli, therefore, is one of the most trying in southwestern China.

In 1921 I had come overland from Bangkok, Siam. I passed through the entire length of that kingdom; thence through the southeastern Shan State of Keng Tung and the whole length of the Province of Yünnan; but nowhere were such difficult trails encountered as those down to and across the Yangtze gorges and over the Likiang mountain ranges to Muli. It takes a hardened constitution and great powers of endurance to make the trip.

I sent my card to the Chinese magistrate of Likiang to announce my start for

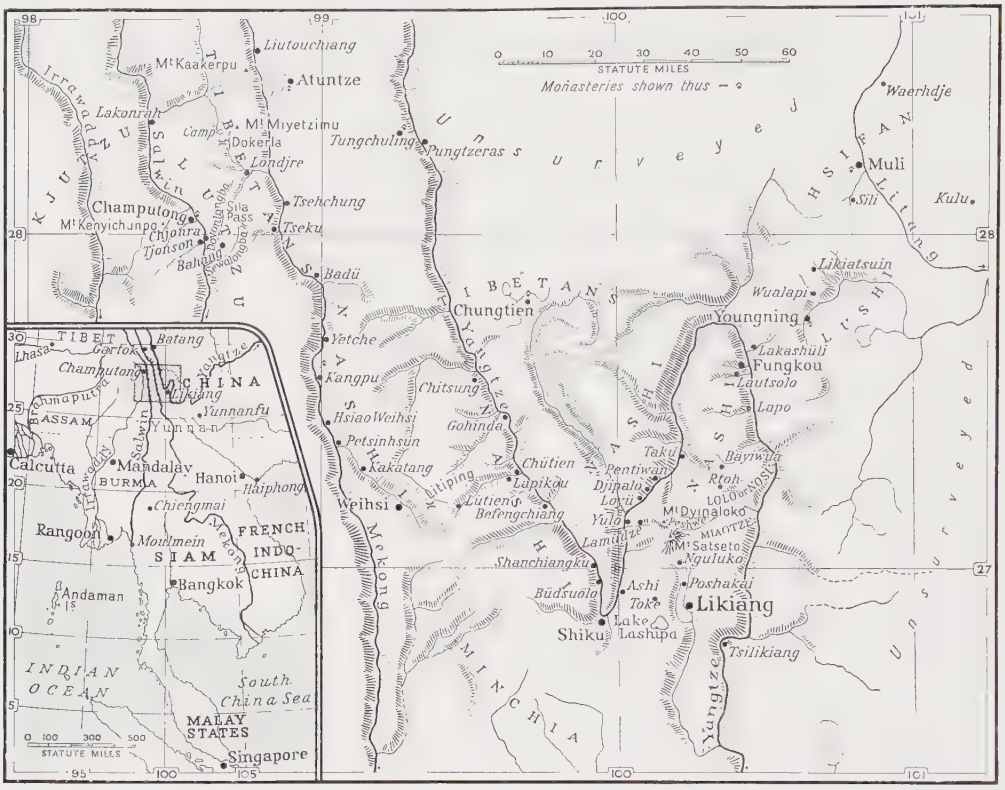
* See "Banishing the Devil of Disease Among the Nashi," by Joseph F. Rock, in the National Geographic Magazine for November, 1924.

MOUNT SATSETO OF THE LIKIANG SNOW RANGE

In the extreme right of the picture is Mount Dyinaloko, the northern peak of the snow range, about 20,000 feet in height (see map, page 450). This photograph was made at an elevation of 12,000 feet. The trees in the foreground are *Pinus sinensis yünnanensis* and *Quercus semecarpifolia*.

LOLO (NOSU) WOMEN OF THE PINE FOREST REGION NORTH OF THE LIKIANG PLAIN

The houses of these primitive people are of rough pine boards, tied together with cane, and the roofs are weighted down with rocks. The women wear a peculiar headdress of black cotton cloth.



Drawn by Chas. E. Riddiford

MAP SHOWING THE YÜNNAN PROVINCE TERRITORY, WHERE A NATIONAL GEOGRAPHIC SOCIETY EXPEDITION WAS AT WORK FOR TWO YEARS

The leader of the expedition, Mr. Rock, made his headquarters at Ngulukö, north of Likiang. In the accompanying article he describes his trip to the little-known lama kingdom of Muli (near the upper right corner of the map). The route followed a trail from Ngulukö northward, across the Peshwe; through mountains inhabited by the Lolo, or Nosu, to Bayiwua; up the Yangtze to Lapo, Lautsolö, and Fungkou; across the river by ferry; thence to Youngning, Wualapi, Likiatsuin, and Sili to Muli. The shaded square of the inset map shows the area covered by the expedition.

Youngning, capital of the Lüshi tribe, on the border of Yünnan and Szechwan. I was careful not to mention Muli, else he would have blocked my way. I requested, as is customary and even obligatory in Yünnan, the necessary military escort for the journey.

WARNED AGAINST BANDITS

The magistrate politely sent his card, beseeching me to abstain from traveling at that time of the year, for it was near to the Chinese New Year, when robbery increases a thousandfold and all roads are practically closed to traffic.

The reason for this situation is that every Chinese, and such tribespeople as have adopted Chinese customs, must pay their debts on Chinese New Year, no matter where or how they get the money. Many debtors, who find themselves without means wherewith to pay their obligations, turn brigands to save their reputation and to enhance the possibility of borrowing again soon after Chinese New Year. Few people will venture out on trails or roads at that particular time.

When I persisted in my determination, the magistrate sent word that, under the circumstances, he could not furnish me with an escort. I sent my card again, with the brief remark that I would start the next day at 6 a. m. He made no reply this time, but in the evening there appeared at my village ten Nashi soldiers

fully armed with Austrian guns of the vintage of 1857.

These weapons were muzzle-loaders and in woeful condition. Some were tied with string and others were nailed together to keep them from falling apart.

A few of the soldiers were boys of 14 or 15 years of age, whose bosoms swelled with the importance of their office. To them it meant harassing the people. One is obliged to pay these soldiers, and often they give more trouble than actual help. They settle on a village like flies on a pie, and rarely pay for what they eat, but bully the farmers if the best is not forthcoming. They usually help themselves to what they want, and none dare say them nay.

Much to their disgust, I made it a point, as long as any soldiers were with me, to make them pay for everything they took or ate.

Before our departure the men were lined up and given their instructions.

Six soldiers were to go with me and four with the caravan, which consisted of eleven mules and three riding horses.

The region we were about to traverse is sparsely settled and so mountainous that hamlets are perched on cliffs like swallows' nests against a wall. Hence we had to take sufficient provisions for at least a month, both for myself and the ten Nashi guards. Even horse beans had to be carried for my riding horses, as little forage could be obtained beyond Likiang.

THE MULI REGION IS A TRIBAL LAND OF BABEL

No Chinese are encountered on the whole trip of 10 or 11 days to Muli. The land is inhabited by Nashi, Lolo, Lüshi, and Hsifan. Each tribe speaks a distinct language and, what is still more curious, has besides its own name several others which are given it by its various tribal neighbors. This is a land of Babel.

The region of Likiang, once the capital of the powerful and warlike Nashi kingdom, is now inhabited by tribespeople who have come in contact with the Chinese, and who are therefore somewhat more civilized than their kinsmen living in the hinterland, deep in the great Yangtze loop. The latter seldom meet travelers of any kind, and only on rare occasions visit Likiang, a conglomeration of mud huts and a market place, which is to them a metropolis of marvelous splendor. News is exchanged by word of mouth, for no such thing exists as a newspaper.

THE START FOR MULI IN MIDWINTER

We left Ngulukö (see map, page 450) on a cold winter morning. The wind was howling furiously and huge masses of dry snow were being whirled hundreds of feet into the air from the peak of Satseto. The northern end of the Likiang plain, in summer a veritable flower garden, was dry, brown and wind-swept, studded here and there with evergreen oak scrubs and gnarled pines.

The gale from the southwest fairly pushed us along and almost off our horses.

The trail is poor, and one has to pick a way over limestone rock as sharp as a knife blade.

After crossing a pine-clad spur, we followed what appeared to be a volcanic rift or fault which extends the entire length of the eastern end of the Likiang plain. Then we descended to a magnificent meadow, or rather basin, hemmed in on the west by the wonderful snow range, with its glaciers and forests of larch, spruce, hemlock, fir, and pine, and on the east by a gently sloping wooded mountain range with hanging alpine meadows.

No wind disturbed this haven, and although it was the middle of January, blue primroses peeped above the ground, as if to say, "Let us be the first to enjoy this lovely scenery ere lightning flashes and rolling thunder announce the coming of a rainy summer."

Two mighty gashes carved by ice appear in the rock wall of the snow range. They mark the headwaters of the glacier-fed Peshwe and Heshwe, the white and black streams which, a few miles beyond, unite to mingle their waters with those of the great Yangtze.

Here groups of Nashi were busy felling trees and hauling them on pairs of solid wooden wheels across the plain, over rock and brush, to distant Likiang. The foresters were unkempt and forlorn-looking, with long hair often braided into pigtails.

Ahead of us we saw a mountain some 15,000 feet in height. To our left was

THE NASHI MILITARY ESCORT AND LAY ASSISTANTS OF THE AUTHOR

The expedition passed through this dense forest of Yünnan hemlock (*Tsuga yünnanensis*) en route to the Yangtze north of Bayiwua, at an elevation of 11,000 feet (see page 455).

the glorious range which, in all its splendor, reaches northward with its turrets, castles, and deep chasms. On beholding it, no one would dream that the waters of the Yangtze have triumphed over the mass of rock and cut their way north, only to be turned south again by a lower range.

THE YANGTZE ON THREE SIDES

No person, unless he has studied the map (see page 450), would surmise that he is almost surrounded by the Yangtze.

Here hidden among a maze of peaks and hemmed in by mighty walls, this majestic river later becomes the bearer of prosaic burdens in its lower reaches, through the heart of China.

We entered a grove of spruce and hemlock, then descended over an icy trail to the foamy Peshwe, which danced over rocks and boulders, its banks bordered with giants of the forest and flower-laden rhododendron.

A small stone arch bridge spans this stream near the scene of a bloody battle some months ago, when 1,200 Tibetan brigands came within 20 miles of Likiang. A skirmish took place between Chinese soldiers and Tibetans. The former were nearly annihilated, while only one Tibetan lost his life. His garments, or what was left of them, were still hanging on a bush. Farther on we found an empty coffin in the middle of the trail, left behind by the Chinese, who could not recover all their dead after the skirmish.

As we progressed through forests of oak, fir, spruce, and hemlock, interspersed with rhododendron and canebrake, snow covered the mossy carpet of the sloping hillsides. High above us the brown alpine meadows, bordered by black firs, were crowned by crags and rocky walls culminating in Mount Dyinaloko.

AN OLD WOMAN OF THE LÜSHI TRIBE WHO DARED TO FACE THE CAMERA

The Lüshi inhabit the region between the Yangtze and the Litang rivers. The author's interpreter found it impossible to converse with these people, for their language is more than a mere dialect of the Likiang Nashi. Note the skirt of the woman in the right background; she is fleeing from the camera.

THE PRIMITIVE LOLO ARE FOREST DWELLERS

Amid this grandeur we pitched our tent for the night. The air was bitter cold and the soldiers sat around a roaring fire. Shots were fired to let marauders

THE YANGTZE FERRY BELOW FUNGKOU

The saddle horses of the National Geographic Society's Expedition are being loaded on the leaky ferry, which made ten trips to get the party across (see text, page 458).

know that we meant business in case of attack, and soon all slept peacefully on the first stage of our journey to Muli.

A glorious sunrise awakened us after a restful night. The intense cold at this elevation, some 12,000 feet above the sea, made everyone move quickly, and we soon were on our way through a region inhabited by the primitive Lolo tribespeople who move noiselessly through the weird, somber pine forests which provide boards for their humble dwellings. The logs are roughly hewn and placed on edge in a way that makes windows for ventilation unnecessary. The roofs are of the same material and weighted down with rocks.

The Lolo women wear skirts decorated with old-fashioned flounces, reaching almost to the ground, and short jackets (see page 449). Hats, with broad, flopping brims, resembling the heads of antediluvian ichthyosaurs, usually cover their wild-looking, unkempt heads. Most of the children look miserable, with their distended stomachs and with legs like matches.

The quiet of this uncanny forest, with its ghostlike settlers, left me in a melancholy mood until I reached the Nashi hamlet of Bayiwua, situated on a hillside, with a glorious view of the Likiang snow range, and especially of Mount Dyinaloko, with its battlemented crest.

We stopped for the night in the lovely little temple on the hilltop overlooking this hamlet.

What a panorama! After the sun disappeared, magnificent rays streamed forth above the mountain battlements. The snow range assumed the aspect of an icy dragon floating in mid-air, for the deep valley was filled with smoke-blue mist, and only the peaks and ice fields reflected the silvery light of the full moon.

The Nashi of Bayiwua differ from those of Likiang. They are more primitive, for they live secluded among these endless forested hills and mountains. Their womenfolk are very homely and as shy as deer.

They also dress differently from their sisters of the Likiang plain. They wear a much-pleated, whitish skirt with a col-

THE YANGTZE AT FUNGKOU, LOOKING SOUTH (SEE TEXT, PAGE 458)

ored border, together with a short jacket, and from their ears hang huge rings of copper or silver, according to the wealth of the family. These earrings are so heavy that they are fastened to a string wound round the ear or tied over the hair.

The men wear blue cotton trousers and goatskin jackets, with the hair next to the cotton shirt or blouse. They manufacture nothing, but lead a very primitive existence.

Long before sunrise, I stood on the platform before the temple gate to watch the snow peaks turn from gray to pink. Soon the range was blood-red, while the blue smoke which rose from the houses at our feet lay over the valley like a veil, pierced here and there by the dark tops of the fir trees.

MASTIFFS GUARD NASHI SHEPHERDS' CAVES

We wended our way over hill and meadow through thick forests. To the east was a deep chasm which led into the Yangtze gorge thousands of feet below us. For hours our road led through lovely hemlocks (*Tsuga yünnanensis*), whose trunks reminded me of the pillars of the temple of Karnak (see page 452).

We met a Tibetan caravan from Tachienlu, some 20 days to the northeast of us, and were told that the road was free of brigands, and that we had nothing to fear. This put us all in good spirits.

The third evening our camp site was a small meadow in a somber spruce forest near a little icebound brook. Back of us a limestone wall hundreds of feet in height, pierced by black caverns, invited inspection, and while the boys prepared supper I climbed to the foot of the cliff.

I found the caves inhabited by Nashi shepherds and guarded by mastiffs. The larger caverns sheltered the flocks, while smaller ones, mere shelves in the sheer wall, were occupied by the shepherds. Pine-log gates prevented the sheep from straying. On my approach the shepherds hid themselves and would have fled, had that been possible.

The fourth day we crossed the eastern slopes of Laposhan, a huge mountain mass of limestone peaks and crags. Up and down we climbed over several passes, frozen brooks, and marshy meadows covered with ice and studded with low, blue-

THE LEADER OF THE NATIONAL GEOGRAPHIC SOCIETY'S EXPEDITION, WITH HIS ASSISTANTS, AT THE SUMMIT OF THE YANGTZE-YOUNGNING WATERSHED—ELEVATION, 12,550 FEET

flowered rhododendron. After following a lateral ridge, we had a wonderful view of the deep Yangtze gorge, with its dome-shaped spurs, reminding one of the Grand Canyon of the Colorado. The river was not visible.

We then descended over a dry, rocky, narrow spur covered with scrub oak, rhododendron, and pine. A winding trail led deep down into a mysterious chasm. The sun had set, but we had to continue, as no water could be found anywhere. Finally, in utter darkness, we reached a Nashi hut and a terraced, rocky cornfield on the edge of a precipitous canyon. My tent was pitched in this field.

We had just settled down for the night and I was writing my diary, after a trying day's march, when we were startled by the ferocious growls of leopards moving on our camp. The brook below was narrow and the canyon walls rose steeply. The mules became frightened, and the growls came closer and closer. We began shooting into the inky night to drive the beasts away, but, to our astonishment, the leopards seemed to become infuriated and, instead of fleeing, moved nearer. Big bonfires lighted around our mules finally drove the savage cats off.

After a restless night at our miserable camp, we wound down the rocky chasm to the hamlet of Lautsolö, inhabited by poor Nashi people sadly afflicted with

LÜSHI WOMEN OF YOUNGNING IN TRIBAL COSTUME

The long, supposedly white, pleated skirts reach to the ground and are most uncomfortable for walking. On their heads the women wear strings of amber or, in the absence of amber, yellow-colored wooden spools interspersed with red and black ones. These women are relatives of the chief prince of the Lüshi tribe.

VIEW FROM THE TOP OF THE ISLAND OF NYOROP'HU, IN YOUNGNING LAKE, LOOKING TOWARD LION MOUNTAIN

goiters. Our trail crossed the stream and ascended the other wall. The track was narrow and dangerous. One misstep would have landed us in the yawning chasm.

The scenery in the direction of the Yangtze gorge was magnificent; words cannot describe the grandeur of those sculptured mountains. From the summit of a spur, we beheld a blue ribbon of water thousands of feet below. A narrow canyon opened out into the main Yangtze gorge to our east, culminating in enormous limestone crags. The Yangtze disappeared in a narrow defile to the south.

A few hours over a rocky trail brought us to the scattered town of Fungkou and to a public ferry over the Yangtze (see page 454).

As it takes time for a caravan to cross a river, we decided to camp for lunch near the tiny hut of the opium-sodden, though friendly, Nashi who had charge of the ferry. The elevation here is less than 6,000 feet and the heat was intense.

The river at this point is placid, at least in winter, and the current gentle, but in summer it is very dangerous and often impassable.

The view to the south down the haze-filled gorge was awe-inspiring. From here to Lapo the Yangtze is unknown, for no white man's foot has ever trodden its rocky and cliff-bound banks. I was informed that only a very narrow foot-path skirts the arid rock walls of those gorges, and that the heat is stifling in the canyon.

After much shouting and pushing, mules and packs were finally set across the Yangtze. The transfer necessitated ten trips of the leaky boat. Soon the animals were resaddled, and on we went

A TIBETAN SHRINE ON NYOROP'HU IN LAKE YOUNGNING (SEE ALSO PAGE 458)

The island is surrounded by a mud wall with several watch towers. It is plentifully provisioned. The house was built mainly as a place of refuge in case Youngning should be attacked by brigands or by the hostile neighboring Lolo. The National Geographic Society's party spent a pleasant day on the islet.

over grassy hillsides past an imposing lama structure, the repository of native offerings.

We were now in the semi-independent country of the Lüshi, a branch of the Nashi tribe.

A NASHI APOLOGIZES TO HIS GODS

A mighty mountain range and deep chasms still lay between us and the Youngning plain. We stopped for the night at a hamlet, where I took possession of a private shrine in a Nashi house, and, as is always necessary, had the place given a thorough cleaning. That done, I went for a walk while awaiting my belated caravan.

In the meantime the owner of the house, as if to apologize to the gods for the intrusion of the foreigner, filled the room with a nauseating incense. The offering was accompanied with beating of drum and gong. As there were no windows, there was no way of ridding the room of the sickening smoke. I was forced to camp in the open, with the sky as my roof. The full moon shone so brightly that it was difficult to sleep.

The climb out of the Yangtze gorge proved as difficult as the descent. To our right wound a trail long spurned as unnegotiable, for summer torrents had converted it into a rocky stream bed. Following it we wandered in great zigzags, up, up, up.

In the clearness of the autumn air, the scenery at our feet must have been superb, but the winter haze hid much from view, although it increased the mystery of the deep gorge.

After a wearisome day on the trail, we reached an ideal camping ground, cool and pleasant, for we were now 10,000 feet above the sea.

One more steep climb over the last great range separating the Youngning plain from the Yangtze gorge would take us to the capital of the Lüshi.

A glorious morning, perfumed with the odor of balsam fir and spruce, found us on our way through limestone ravines with icebound brooks.

THE BEAUTIFUL LAKE OF YOUNGNING

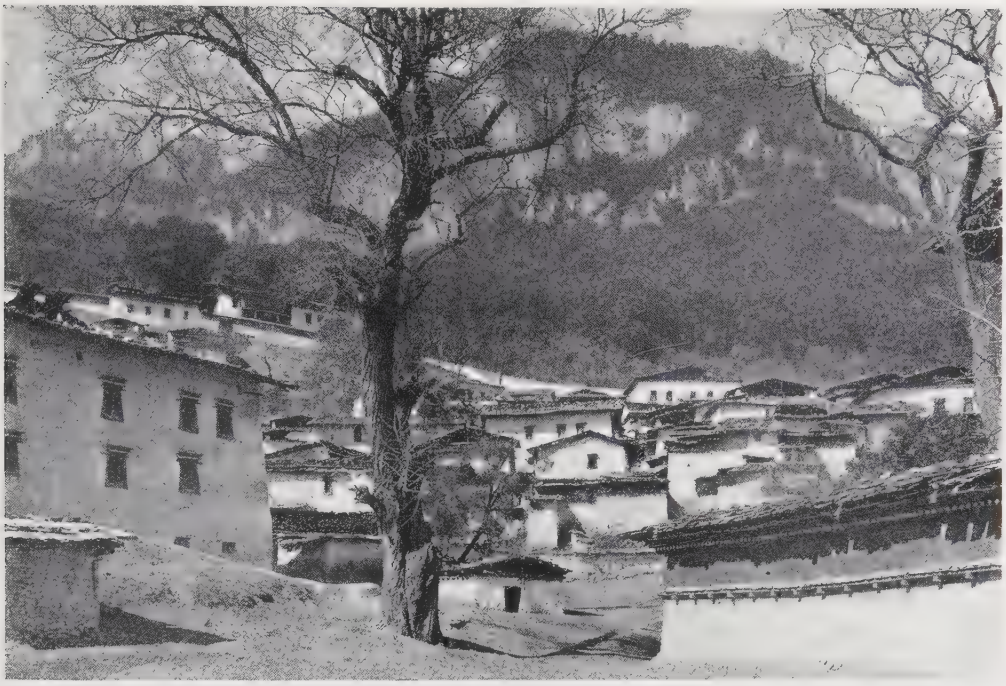
Half of the lake is in Yünnan, the other half in Szechwan. The vegetation on the surrounding hills is mainly *Pinus sinensis yünnanensis* and *Quercus semecarpifolia.*

A GROUP OF LÜSHI TOMBAS, OR WITCH PRIESTS, SEATED IN A FIELD ON THE YOUNGNING PLAIN

Like the Likiang Nashi, the Lushi have Tombas, who are engaged solely for the purpose of dealing with and driving out evil spirits which cause illness, bad luck, etc. (See "Banishing the Devil of Disease Among the Nashi," in the NATIONAL GEOGRAPHIC MAGAZINE for November, 1924.) These priests are surrounded by drums and bowls full of gods made of dough, and other paraphernalia. In front of them, not visible in the picture, was an altar of pine sticks, oak branches, and perforated paper smeared with pig's blood. They were concerned with the driving out of a devil who had caused a stomach ache in a village headman.

LOOKING UP TO MULI FROM THE BANKS OF THE LITANG RIVER

The walled capital of the lama kingdom can be seen on the top of a hill just below Mount Mitzuga (see also page 466).



WITHIN THE WALLS OF MULI, SHOWING THE DWELLINGS OF SOME OF THE 700 LAMAS

This view of the lamasery was taken from a vantage point near the king's palace.

We zigzagged through a gloomy wood to the summit of the range. A flood of sunshine burst upon us as we reached the top, a flat expanse of lovely forest land.

A log cabin, with smoke issuing from beneath the roof and cracks of walls, gave shelter to some Lüshi who guard the pass and flee at the first sign of approaching bandits to warn the chiefs of the Youngning monastery.

THE EXPEDITION ARRIVES AT YOUNGNING MONASTERY

It was a pleasant contrast to pass from the enormous canyons and ravines to the Youngning plain, which swarmed with duck, heron, crane, and geese. That afternoon we reached the monastery and its hospitable shelter, being guided by the chief lama's secretary, an unkempt, beardless monk.

Youngning, known to the Nashi as Yuling, or Yuli, as they are unable to pronounce a final ng, is the seat of three chiefs whose ancestors were Mongols, elevated to power by Kublai Khan in the 13th century.

Here we learned for the first time that the old Muli king had died of dropsy the year before, and that his younger brother had now been on the throne for four months. The latter was said to be an amiable man and much more hospitable than his late royal brother, who two years before had told me politely not to visit him.

Leaving Youngning, we followed the western margin of the plain along a trail lined with roses and prinsepia shrub. The latter has fleshy stems on which white drooping flowers are arranged in a row like dewdrops.

AN ENCOUNTER WITH A RICHLY CAPARISONED CAVALCADE

A walk of a few miles brought us to Wualapi, a squalid Lüshi hamlet built on a hillside.

From Wualapi to the boundary of the Muli king's domain is only a short distance.

The first Hsifan village across the border is Likiatsuin, a two days' journey from Muli.

A HSIFAN WOMAN OF MULI PHOTOGRAPHED IN THE MULI VALLEY

She came to the author's camp to sell grass for the horses. On her head she wears a bandeau of amber and gilded rupees.

After an arduous climb, we came upon a glorious alpine meadow, a rolling hillside framed by black fir and hemlock—mighty trees 150 feet in height, with trunks from 5 to 6 feet in diameter. No woodman's ax has ever echoed there.

Hark! A cavalcade of 20 men approaches, clad in brilliant red garments and gold-brocade jackets. They ride on red saddle blankets trimmed with leopard's fur. Each carries on his left side a miniature Buddhist shrine of silver, a reliquary for protection on the journey.

A lama of lower grade stops one of my men and roughly demands to know whither we are bound.

Before an answer can be given, the priest motions my man to get off the path, as the king's brother is approaching.

The Nashi answers curtly, "Get off yourself, for my master is behind me."

I now take part in the interchange of "civilities," giving the lama a lecture accompanied by threatening gestures. Out comes the priest's tongue in deference, which, with upward-pointed thumbs, denotes the most humble mode of greeting where Tibetan customs are in vogue.

We pass the cavalcade without a sign of recognition by either party.

HOT WATER FREEZES ON HANDS AND FACE

On we climbed over a steep and rocky trail. High cliffs were to our left, with hanging boulders supported by the roots of fir trees which had found a lodging in the cracks. The sky turned black, a stillness filled the forest; the watch showed 5 o'clock and we were yet a long way from the predetermined camping place.

Since our caravan was not in sight, we decided to stop for the night on a tiny meadow near a cliff. Deep snow lay all around us, but there was no water. A blizzard swept down from the mountain crags through the forest, and we huddled together for protection around the huge trunk of a fir tree. The mules arrived half dead; there was no shelter for the night, and leopards were prowling around.

Had we gone farther, however, it would have been colder, for the aneroid already registered 14,000 feet above the sea. With numb fingers we pitched our tents. The snow continued and the wind increased in violence. We melted snow

for coffee and cooked a makeshift supper; then crawled into our blankets.

A glorious morning greeted us, but the cold was so intense that hot water froze on my face and hands when I attempted to make my toilet. We were glad to leave this camp site.

We reached the pass, 15,000 feet above the sea, in gorgeous sunlight. To our right was a line of crags, snowcapped and glistening like diamonds.

The pass is supposed to be infested with brigands, who lurk behind the stupendous crags, but we were not molested.

We descended through a steep forest of spruce and fir, with rhododendron trees as underbrush; lichens and mosses covered trunks and boulders. All was hushed.

The trail led down a spur jutting out into a deep canyon in which flows the Muli River. To the left a high range, crowned by volcanic cinder cones of perfect shape, testified to the mighty upheaval which once occurred here.

A LÜSHI WOMAN OF THE VILLAGE OF WUALAPI

She carries water in a wooden tub on her back.

One of my soldiers took me to an open spur and pointed north, where, upon a sloping hillside, lay Muli, bathed in the sunlight. I also looked upon a sea of mountains, range upon range, like the furrows in a field, with a deep ravine from north to south, down which runs the Litang River, flowing eastward into the Yalung, which in turn empties into the Yangtze, some weeks' journey distant.

As it would not do to arrive in Muli unheralded, I dispatched a soldier with my card to the lama king, and a message that I would enter the capital early the following day. Some of my Nashi men, who had been to Muli several times, were anxious that I give proper presents to the king, lest we be uncivilly received.

A LAMA EXTENDS A WELCOME TO MULI

We pitched camp on the bank of the Muli River, 8,000 feet above the sea, and here we made our first acquaintance with Muli villagers, especially the women, who barter grass and barley for the horses of caravans. Their dress consisted of dark-gray woolen skirts with fringes, and leather jackets. Their wealth of hair, a good deal of it false, was decorated with garlands of gilded Szechwan rupees, a coin common in this region (see page 464).

THE LAMA CITY OF MULI, ON THE SLOPES OF MOUNT MITZUGA, OVERLOOKING THE MULI AND LITANG RIVERS

The massive building in the foreground is the king's palace. The large building at the upper right is the most sacred shrine of Muli (see page 477).

At dawn we broke camp on the river, now only a bubbling brook, and climbed the western hillside. We had gone about two miles when we met a lama, dressed in deep-red woolen cloaks, and riding on a horse whose saddle blankets were made of leopard skins and Tibetan rugs.

He dismounted, took off his turban, bowed deeply, and humbly presented the king's card, then made a little speech in Tibetan, which my cook, whom I had asked to ride with me to Muli instead of staying with the caravan, interpreted as kind greetings and an invitation to be the king's guest.

The lama led the way up and around the hillside, past prayer pyramids of carved rock bearing the ever-present sacred formula, *Om Mani Padme Hum* (Oh, the Jewel in the Lotus, Amen).

Turning a sharp curve around a spur, we were confronted with the walls of Muli and the main gate to this lama stronghold. A row of courtly priests stood waiting and bowed at my approach.

I was conducted along the wall to a new house with a terrace, outside of Muli proper, and when I was comfortably settled, I was asked when I wished to see the king, who was anxious to meet the stranger.

I requested the lama to convey my greetings to His Majesty and say that I would call as soon as my caravan had arrived, after I had changed my riding clothes for those suitable to wear in the presence of royalty so illustrious as the King of Muli.

MULI IS BOTH CAPITAL AND LAMASERY

The rulers of Muli are said to be of Manchu origin. They were given the sovereignty of the kingdom in perpetuity in recognition of valorous services rendered to Yungcheng, the famous Manchu emperor, who ascended the throne in 1723 of our era.

The King of Muli holds sway over a territory of 9,000 square miles—an area slightly larger than Massachusetts—but he has only 22,000 humble subjects.

The kingdom is so mountainous that it is impossible to cultivate the soil except along the Litang River and in the narrow valleys of its tributaries descending from the mighty ranges.

Though Muli is the capital, it is in reality only a lamasery of 340 houses tenanted by 700 monks, who pray unceasingly. The villagers occupy wooden shanties scattered over the hillsides below the town. They are very poor, and live in constant fear of the lama king and his parasitic satellites. The kingdom boasts of 18 lamaseries—3 large and 15 small ones.

Next in importance to Muli lamasery comes Waerhdje (or Wachin), about 18 miles to the north, as the crow flies. It has 270 lamas. The third large lamasery is Kulu, with 300 lamas, lying about 25 miles southeast of Muli.

The king, followed by his government, resides one year in each, always in the same rotation—Muli, Waerhdje, and Kulu. Of the other places in his kingdom he knows nothing.

The Muli lamas belong to the yellow sect of the reformed Tibetan church. Their cloaks are always red, but the distinguishing mark of the sect is the yellow ceremonial hat. It is usual for two or three out of every five male members of a family to become lamas. When there are three brothers in a family, two become lamas, and the third often marries several wives to carry on the family.

The dignity of prince lama is hereditary, a successor always being chosen from the brothers or nephews of the deceased. The ruling lama is called *Gyalpo*, or king, and confines himself to civil and judicial administration, although he is also vested with full ecclesiastical authority. The next highest official in the kingdom, except perhaps the Living Buddha of Muli, is the lama lord high treasurer, the second lord commissioner.

In matters affecting Chinese interests, the king is supposed to communicate with the prefect in Yenyüan, 70 miles to the southeast, or in Ningyüanfu, 90 miles to the east. However, no notice is now taken of any Chinese magistrates, who are only too happy to be left alone in their insecure position, while the lama king is firmly entrenched.

Muli is a rich possession, as all the rivers, especially the Litang, carry gold and produce a considerable revenue. Rights for washing and mining gold are vested in four lamas under the king, who exercises a jealous control.

THE GATEWAY TO THE PALACE OF THE KING OF MULI

The building has massive rock walls several feet thick; the open bay window of the top floor is in the lama king's reception room. The walls are whitewashed and the stone window frames are painted an ultramarine blue (see page 478).

The lay population is subject to military service, and the king's levies are called out almost yearly to ward off attacks by Mantzu tribes bent on pillage.

THE VISITOR PASSES THROUGH A STABLE TO REACH THE THRONE ROOM

My caravan finally arrived. I donned my best and sallied forth to meet the king. The prime minister, or lord treasurer, and the king's secretary, who spoke Chinese excellently, accompanied me to the palace—a large stone structure on the lower edge of Muli, built 60 years ago.

I took with me my Siamese boy, the Tibetan cook, and two Nashi servants, all dressed in their best and carrying as presents for the king a gun and 250 rounds of ammunition.

We were escorted to the palace square, which is surrounded by a temple, from which issued the discordant sounds of trumpets, conch shells, drums, and gongs, besides weird bass grumblings of officiating monks.

The gateway to the palace was imposing. At either side of it two large bundles of whips were displayed to impress the villagers.

Immediately within the gate is the king's stable, ill-smelling and dark, leading into a small, oblong courtyard graced

CHIMNEYS IN FRONT OF THE PALACE AT MULI

These are used to burn pine branches and incense as spirit offerings. In the foreground is a Muli villager.

by a stunted tree, supposed to lend cheer to the somber place.

We ascended a broad, steep stairway in utter darkness. The steps were close and narrow and the railing was so low to the ground as to be useless. I had to feel my way.

AN AUDIENCE WITH THE KING OF MULI

Two flights up and we stood before a greasy curtain, black from the marks of buttered fingers. A Hsifan servant drew it aside and we passed through an ante-chamber, then a large, bright room, and we were in the presence of the king.

On my approach he rose, bowed, and beckoned me to a chair next to a small table loaded with Muli delicacies. He occupied a chair, facing me.

I had great difficulty in distinguishing my host's features, as he sat with his back to the light coming from an open bay window, while he watched every muscle of my face.

The king stood 6 feet 2 inches, in high embroidered Tibetan boots of velvet. He

THE KING OF MULI IN HIS ECCLESIASTICAL ROBES

His Majesty posed for this photograph on his throne, in the reception room of his palace. Compare with the photograph of the king wearing his elaborate robes of state, on the opposite page.

THE KING OF MULI IN THE ROBE AND HEADDRESS OF A TEMPORAL RULER

A kneeling lama removed the monarch's boots before he mounted his throne to pose for this picture (see text, page 479). Note the magnificent silk embroideries which are used for a background.

THE EASTERN PART OF THE MULI LAMA MONASTERY AS SEEN FROM SOUTH OF THE PALACE SQUARE
At the left is a flag (prayer) staff and in the right foreground is a part of the palace.

THE BODYGUARD OF THE KING OF MULI IN FRONT OF THE PALACE TEMPLE

The two lamas in the center are the highest military officials of Muli. Their togalike uniforms of red partly conceal their jackets of gold brocade (see text, page 480).

TWO HSIFAN WOMEN OF MULI WHO ACCOMPANIED THEIR HUSBANDS TO THE CAMP AT AGÙ (SEE PAGE 491)

was 36 years old, of powerful frame; his head was large, with high cheekbones and low forehead. His muscles were weak, as he neither exercises nor works. His manner was dignified and kind, his laugh gentle, his gestures graceful.

He wore a red, togalike garment, which left one arm bare. Below the tunic was a gold and silver brocaded vest and on his left wrist a rosary.

The king has one younger brother, a lama destined to rule, and one older brother, a coarse individual, who looks more like a coolie than a prince. The latter, who wore silk garments lined with fur, and uncut diamonds on his fingers, carries on the family.

At the king's right was a group of lamas in most deferential attitudes, with bowed heads and folded hands, awaiting his slightest suggestion. Next to the lamas stood my servants, much bolder than the king's prime minister.

I spoke first, saying that I had heard much of the splendors of Muli and of the king's beneficence, and that I had long wished to meet him. He replied that Muli was a very poor place, and that he felt honored by my visit, coming, as I had, from so distant a country as America, whence no other man had ever come to Muli.

THE KING ASKS MANY QUESTIONS

I doubt whether until that time he had known of the discovery of America. He did not have the slightest idea of the existence of an ocean, and thought all land to be contiguous, for he asked if he could ride horseback from Muli to Washington, and if the latter was near Germany.

During a lull in the conversation, he whispered to his prime minister, but kept an eye on me. The embarrassed official translated, with folded hands and forward-bent body, a most astonishing question: "Have the white people stopped fighting and are they again at peace?"

The next inquiry was whether a king or a president ruled great China.

Then, the king suddenly held forth his hand, asked me to feel his pulse and tell him how long he was to live! From this he jumped to field glasses, asking if I had a pair with me which would enable him to see through mountains.

He then whispered some orders to a

lama, who, with great reverence and hands folded in prayer, said "Lhaso, Lhaso," a term of humble acquiescence, and, walking backward, retired.

I glanced around the audience chamber. It was a room of considerable size, well decorated with frescoes in rather garish colors, depicting scenes from the life of Buddha and lesser gods. The pillars supporting the ceiling were red and adorned with a sort of gold appliqué work.

Odd as it may seem, in all this Lamaistic splendor there was a Western touch, for on the crimson-painted posts were clothes-hooks with white porcelain knobs, such as one would expect to find on trees in a cheap German beer garden. Suspended from the rafters and from the walls were old-fashioned kerosene cellar lamps, with rusty rings for protection of the chimneys. That they were meant for decoration was obvious, as no kerosene ever reaches this king's domain.

No matches or candles could be had here, and the black, greasy necks of all the lamas, including the king and Living Buddha, showed that soap was not in demand.

THE KING ENJOYS A LECTURE ON WESTERN LIFE

The prime minister soon returned with a stereopticon and some faded photographs. The king evidently thought this a splendid opportunity to satisfy his curiosity. The pictures were handed me one by one, and I had to explain what they represented, from the captions in English on the cardboard. The first was the dining room of the White House, in Washington; the others ranged from Windsor Castle to Norwegian fjords, and wound up with a jolly pre-war crowd in a German beer garden.

I interpreted, as best I could, these representations of our Western life, to all of which the king nodded silently, not much the wiser, I should judge.

After the lecture, the king urged me to partake of Muli delicacies. There was gray-colored buttered tea in a porcelain cup set in exquisite silver filigree with a coral-studded silver cover. On a golden plate was what I thought to be, forgetting where I was, Turkish delight, but it proved to be ancient mottled yak cheese,

A MEMBER OF THE MULI KING'S BODYGUARD

He wears a red-cloth uniform trimmed with leopard skin, high black Tibetan boots with red leather ornaments, and a crimson turban. In his belt he carries a silver-sheathed sword.

THE HEAD OF MULI'S 50-FOOT STATUE OF BUDDHA

The head (face), without the crown, is 10 feet long. The picture was taken from a gallery in a great chapel on the second floor of the palace building in which this huge idol is housed (see page 480).

interspersed with hair. There were cakes like pretzels, heavy as rocks.

It was an embarrassing situation, but, in order not to offend His Majesty, I took a sip of tea, which was like liquid salted mud. I then requested the privilege of taking photographs in Muli, and, if he would permit, some of His Majesty himself; whereupon he smiled in acquiescence. The hour was set for the next morning after prayers.

While we were talking about photography, the king issued an order to the lamas. They rushed out and returned in a few minutes with two huge boxes tied in skins, from which, to my astonishment, they took two cameras of French make, with fine portrait lenses; also an Eastman kodak, boxes with plates, rolls of printing paper, and spools of film—all of which had been opened and examined in broad daylight!

When I explained that all the plates and films and papers had been ruined, they laughed in unison and momentarily His Majesty's presence was forgotten. The king explained that the outfit was a present from a rich Chinese trader who once passed through his kingdom.

There were chemicals sufficient to start a photographic shop, but none of the court knew what they were. They watched me in awe, as I read the labels, and the king, without asking my permission, detailed a trembling lama to come to my house that very afternoon and learn all about photography within an hour!

I pitied the poor lama whose destiny decreed him to be the king's photographer. Although he was a very humble apprentice at my rough studio, he must have wished me elsewhere. He learned about as much that afternoon as the meandering yaks outside my house.

After two lamas brought trays filled with mandarins and pretzels, I bowed and left His Majesty, who accompanied me to the greasy curtain, which he raised to let me pass.

ROYAL GIFTS TO THE EXPEDITION

Hardly had I arrived at my rustic house when there appeared nine stalwart Hsifan men, accompanied by the prime minister, bringing gifts from the king. There were eggs in plenty; a large bag of the whitest rice, two bags of beans for

THE CHIEF SANCTUARY OF MULI SURROUNDED BY A SPECIAL WALL WITHIN THE WALLS OF THE CITY (SEE ALSO PAGE 466 AND TEXT, PAGE 478)

the horses and one of flour; one wormy ham; dried mutton; lumps of gritty salt, more of that doubtful yak cheese, and butter wrapped in birch bark.

All the gift-bearers stood as I distributed silver coins. Three cakes of scented soap were presented to the prime minister.

As the king's porters left, a hungry mob of beggars gathered outside our gate. The dried legs of mutton and yak cheese were literally *walking* all over the terrace of our house, being propelled by squirming maggots the size of a man's thumb. I was informed that these were the choicest delicacies from the king's larder. As none of my party wanted the lively food, we gave it to the beggars, who fought for it like tigers.

All afternoon there droned forth from the sword temple, near the palace, the mournful sound of trumpets, gongs, and conch shells, occasionally accompanied by brass cymbals and the beating of a drum. In the evening, the king's soldiers played the bugles and drums in military fashion; a shot was fired at 8 p. m. and a bugler sounded taps.

When I had opportunity to decipher the king's calling card I learned that though his name is, briefly, Chote Chaba, his full appellation is "Hsiang tz'u Ch'eng cha Pa, by appointment self-existent Buddha, Min Chi Hutuktu, or Living Buddha, possessor of the first grade of the Order of the Striped Tiger; former leader of the Buddhist Church in the office of the occupation commissioner, actual investigation officer in matters relating to the affairs of the barbarous tribes; honorary major general of the army, and hereditary civil governor of Muli. Honorific: Opening of Mercy."

The ruler's knowledge of Tibetan was very poor, and of Chinese he knew next to nothing. He used to reside in Kulu before he became king, and was the Living Buddha of its monastery.

Early next morning the trumpeters were busy and the drummers, too. About 10 a. m. we made our way to Muli proper, within the walls, to take photographs of the temples, buildings, prayer wheels, and other things of note. The king was attending prayers.

The massive palace had window frames

THIS GIGANTIC PRAYER WHEEL HAS A BUILDING TO ITSELF

The prayer house is opened only for one hour after luncheon. The cylinder is of gilded and decorated yak hide (see text, page 491).

painted an ultramarine blue, and decorated ends of beams bearing the Buddhist colors of red and yellow. In the windows were wooden shutters made like doors (see page 468). The windows may now have glass, for I suggested to the king that he have the photographic plates washed and used as windowpanes, since they were useless for making pictures.

The prime minister guided us through Muli, even to the great sanctuary, called Churah, surrounded by a special wall (see p. 477). A rude monk was about to slam the big gate in my face, when he spied the prime minister, and humbly, with outsticking tongue, threw it wide open.

NO PHOTOGRAPHS PERMITTED IN THE CHIEF SANCTUARY

A long flight of rocky steps led to the inner shrine, housing many gilded gods under yellow silk umbrellas. In the center, as if on a throne, was one swaddled in yellow cloth, entirely hidden, too sacred

to be gazed upon. Before this image our guide made deep obeisance.

This sanctuary was the only place where we were asked not to take any pictures unless the king himself were with us and gave permission.

Long cylindrical umbrellas of blue, yellow, and purple silk hung from the ceiling, while against the whole length of the posterior wall was stretched an enormous painting of Buddhistic scenes.

The adjoining house was empty. To the right of the sacred shrine was a garden with a pavilion at the upper end, in front of which was an open platform. To its left was a square, raised seat of stone.

In the pavilion is a throne which Chote Chaba occupies once every three months, when all the lamas gather to undergo examination in the Buddhist scriptures. The beautiful painting forming the back of the throne represents Kwan-Yin, the Buddhist Goddess of Mercy.

We descended through narrow lanes by lama houses, each with firewood stored for the winter beneath the pine-board roofs, to the main palace square.

A ROW OF CYLINDRICAL PRAYER WHEELS OF COWHIDE

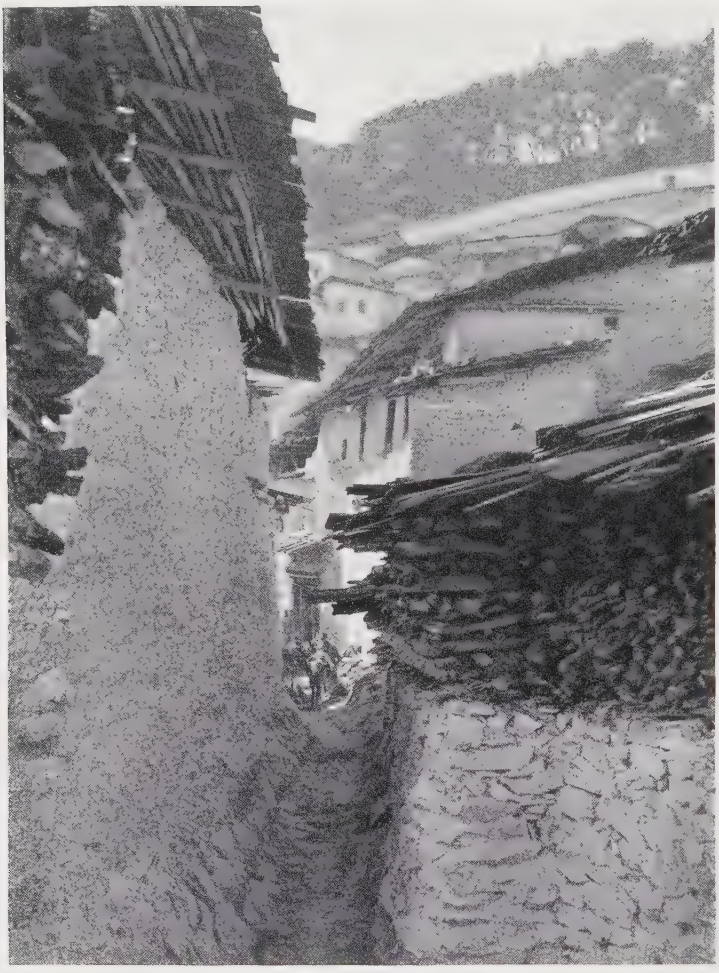
The sacred formula, "Om Mani Padme Hum," is reprinted thousands of times on the paper which is wrapped around the cylinders. This row of prayer wheels is built against the wall of the king's palace, and passing lamas turn each one as they go by (see text, page 490).

PREPARATIONS ARE MADE TO PHOTOGRAPH THE KING

The king spied me from his window, beckoned me upstairs, and received me kindly. Soon I had made preparations to take his first photograph.

I selected a spot against the wall, under the fat-bellied God of Luck. The monks flew in all directions, and brought numerous well-wrapped bundles containing beautiful carpets, tiger skins, gold brocade, and yellow embroidered silks and shawls. The throne was placed on the spot selected, and the carpets, cushions, and hangings arranged satisfactorily (see pages 470 and 471).

After a kneeling lama had taken off the king's boots, he stepped nimbly to the throne and sat cross-legged, his merry, boyish face assuming a solemn expression. A yellow and white silk cloak was placed over his shoulders and a yellow hood upon his head.



LOOKING DOWN A MULI STREET

The thoroughfares of the capital are very narrow and steep and are paved with limestone rocks.

The king's dogs—three King Charles spaniels—jumped on his lap, where they usually repose. With a display of great affection, the royal pets were finally sent away, at my orders.

Then the king sat motionless for nearly 20 minutes, while I took many poses. When all was finished, he stepped gleefully from the throne—a different man.

We sat down and chatted while the new lama photographer was announced. The poor soul crawled into the royal presence on hands and knees and did not raise his eyes until his sovereign touched him on the head in blessing. Then, folding his hands, he whispered with insucked breath an account of the progress he had made in his new office as court photographer.

The king expressed a wish to have me photograph his lama officials and bodyguard, which I gladly did. When I withdrew, he presented me with long bolts of woolen cloth called *pulu*, on top of which he placed his rosary, unwound from his left wrist. We parted the best of friends.

Before I left, the lamas took me to an enormous chapel wherein sat enthroned the statue of a gigantic Buddha, 50 feet in height, made of bronze and covered with gilt and golden bands. Owing to lack of space, I had to be content with photographing the Buddha's head from the upper gallery, where monks were busy making silk hats for the king's entourage.

After luncheon I was escorted to the palace square, where the king's officers and soldiers, his private guard, were assembled. Two lama officers, in spotless red garments and jackets of gold brocade, were the military chiefs of Muli. One was a stout, powerfully built man, with short mustache; the other was lean and almost lost in the folds of his uniform.

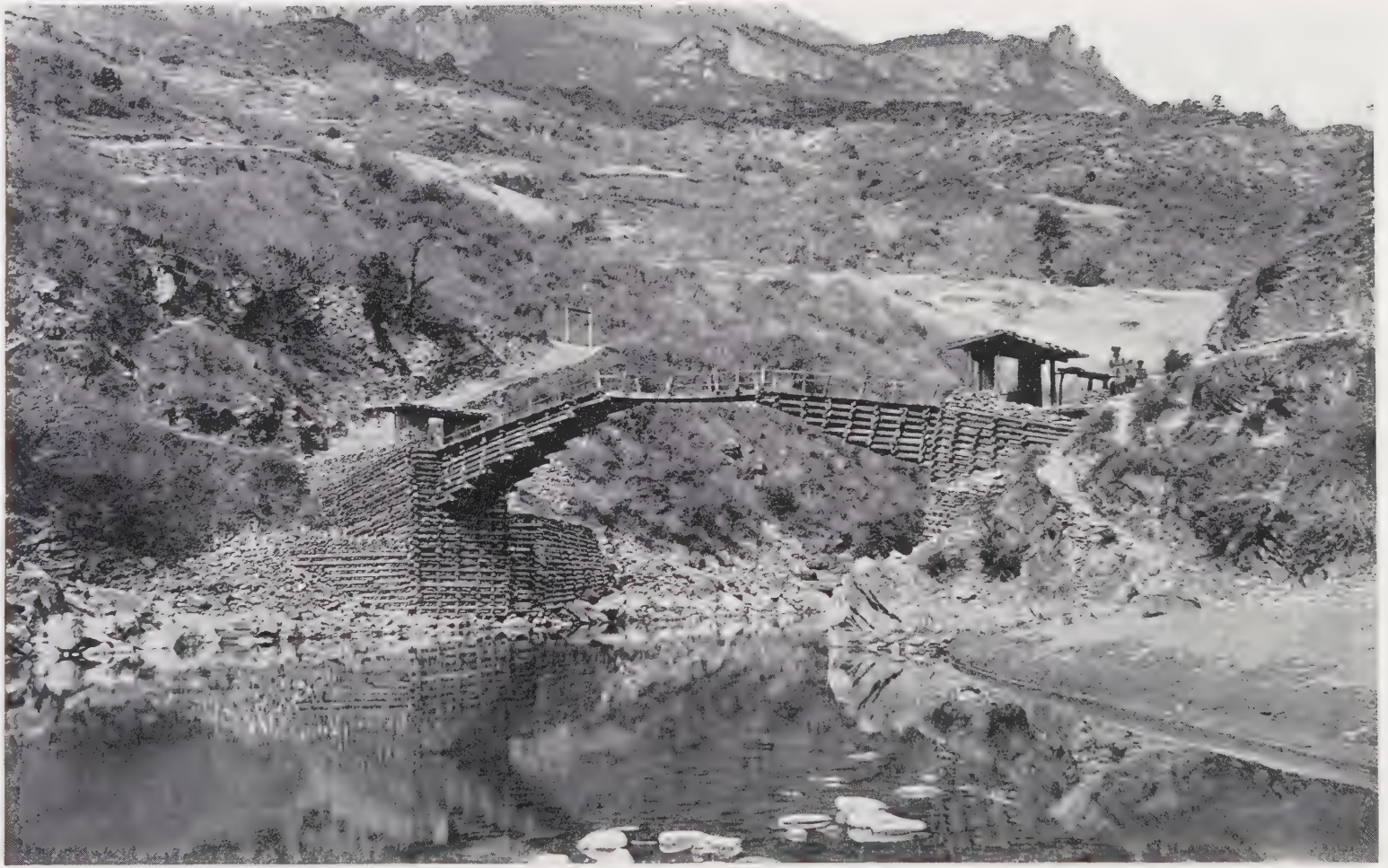
The soldiers were splendidly arrayed in red woolen cloth trimmed with leopard fur. They also wore tall red turbans, Tibetan boots of black cloth trimmed with red leather, and in their sashes short swords in silver sheaths (see page 473).

THE ROYAL CHARGER AND THE LIVING BUDDHA ARE PHOTOGRAPHED

While photographing this colorful military array, the king looked down

A WOODEN BRIDGE OF CANTILEVER DESIGN ACROSS THE LITANG RIVER BELOW MULI

The level of this river, which here flows southward to mingle its waters with the Yalung, is 7,500 feet above the sea (see also illustration, page 482).



THE TYPE OF BRIDGE CONSTRUCTION IN MULI

A succession of logs, superimposed, is built out to support a rickety central portion of boards. The latter section can be removed in case of emergency, as, for instance, to prevent robbers from crossing the river and endangering the capital city.

LOOKING UP THE MULI RIVER. IN THE DISTANCE IS THE YANGTZE-YALUNG WATERSHED

THE KING'S PALACE AT MULI (CENTER)

The roofs of the houses are of pine wood weighted down with rocks. The royal residence is a stone structure, built about 60 years ago. The government of the tiny kingdom is theocratic and the lama ruler resides a year at a time in each of three lamaseries (see text, page 467).

THE LIMESTONE CRAGS OF MOUNT GIBÒH, OVERLOOKING THE MULI VALLEY, AS SEEN SOUTH OF THE PASS

LAMAS IN RED ROBES AND YELLOW CEREMONIAL HATS CONDUCTING A SPECIAL SERVICE (SEE PAGE 490)

This ceremony took place in a small meadow outside the author's house in Muli. To the accompaniment of the beating of drums and the blowing of trumpets 12 feet long, a bonfire was lighted. Many offerings were thrown into the flames to appease the evil spirits.

HSIFAN PEASANTS SENT OUT BY THE KING OF MULI TO PREPARE A CAMP FOR THE NATIONAL GEOGRAPHIC SOCIETY'S EXPEDITION

The camp, known as Agu, was situated in a small alpine meadow surrounded by a lovely forest, at an elevation of 12,000 feet (see text, page 401).

THE LIVING BUDDHA OF MULI MOUNTED ON THE KING'S CHARGER

This eighteen-year-old boy, head of the lamas of Muli, is a Tibetan and not a Hsifan. His parents were beggars (see text, page 489). His mother now has a home outside the monastery walls, while he lives in luxury and splendor, being worshiped even by the Muli king. In the background is the king's temple, with curtains twisted around the columns.

upon the scene from the palace window. Presently he sent word that he wished me to photograph his charger fully caparisoned; but to this I demurred unless the king should come down and ride the horse. He declined, saying there were too many people about, and that he did not wish to be seen. He would, however, send down the Living Buddha of the monastery. This pleased me more, as the latter had not yet come before the camera.

The royal steed was an old "plug," unworthy of its splendid trappings. The saddle blanket was of heavy golden-yellow cloth, with a border of Buddhist emblems. Over it was placed another of silk and gold brocade, and on them a saddle frame of gold, beautifully carved, and covered with a heavy cloth of golden thread. The leather straps were similarly covered. Over the horse's mane hung magnificent silk drapings of purple, yellow, blue, and gold. A golden knob resembling a Buddhist stupa was placed ceremoniously on its head.

When the horse was fully arrayed, the Living Buddha came through the somber palace gate. He was a boy of 18 years, fairly handsome, with rosy cheeks glowing from behind an unsuccessful wash. He wore the regulation lama robe of red, with gold brocade, and from his shoulders flowed a silken mantle with embroidered disks and borders. Then appeared the lord high treasurer with a hat of solid gold, wherewith the boy was crowned.

It was a splendid scene, worthy to be recorded on an autochrome plate, but, unfortunately, I could preserve it only in black and white.

The king's temple, with wide curtains twisted around its pillars, made a splendid background. When the Living Buddha appeared, all natives of low degree vanished like the smoke from the incense-offering chimneys in front of the palace. The sky grew dark-gray, and presently snow began to fall. I had to hurry to make the photographs.

HOW A BEGGAR'S CHILD BECAME THE LIVING BUDDHA

This young Living Buddha, who now wore a golden hat and a silken mantle, was the son of a Tibetan beggar family living in a hamlet to the north. When the former Living Buddha of Muli died, he gave directions as to where his reincarnation might be found. The lamas sallied forth to seek his soul in some infant born about the hour of the late Buddha's demise. They took with them certain of the latter's possessions.

Having found a baby born at the specified time, they displayed the objects. When the child reached for a rosary, this was deemed conclusive proof that the true Living Buddha had been discovered. Thereupon the baby was carried with great pomp to the lamasery, to be worshiped thenceforth by all Muli, even the king.

What joy came to that beggar family! His mother now dwells in comfort in a house outside of Muli, while his father has passed on. The boy's title being "Hutuktu," he lives forever, his eternal existence undergoing occasional diversion through changes of his bodily form.

THE KING IS HOST AT A UNIQUE DINNER

The next afternoon I took dinner with the king. The meal was served in the reception room, on separate tables, before the window, while lamas, including the king's brother, held prayer service in his bedroom.

A steaming iron pot inlaid with silver contained a great array of meats vertically arranged in slices, below which were vegetables of every kind. Rice and several other dishes were served, besides buttered tea gray as mud and of the consistency of soup.

Dessert consisted of a bowl of solid cream. Neither spoons, forks, nor chopsticks were placed beside the bowl. Not knowing Muli table manners, I waited for the king to make the first move. He raised the bowl to his mouth and took one smacking lick. I followed suit. It was the best dish served that day, but, as my tongue was not so agile nor of the proper length, I had to leave a good deal in my bowl.

The lama's secretary, who acted as interpreter, sat humbly on the floor and was not offered any delicacies. He had only buttered tea served in a wooden bowl, while ours were of gold.

After informing me that there would be a great procession of the lamas in front of my house later in the evening, the king arose and remarked that the next day he

THE LAMA KING'S SECRETARY, WHO ACCOMPANIED THE AUTHOR TO SILI

He brought as a parting gift from the king a bag of mandarins and walnuts, and, despite his poverty, presented the leader of the expedition with two brass ladles as a personal token of esteem (see text, page 491).

would go out to pray among the hills, but I was to see him late that evening to say farewell.

THE LAMAS MAKE A CEREMONIAL PROCESSION

I had just arrived at my house at sunset when, from the north gate of the Muli wall, stalked forth the religious procession—some 40 lamas preceded by three boys in armor, wearing helmets and carrying long spears. The first group was followed by four minor lamas with two 12-foot telescopic metal trumpets. The two priests in front held up the instruments to the level of the mouths of the two other lamas, whose cheeks worked like bellows and produced bass notes meant to frighten lurking devils.

Other lamas followed with cymbals, while a fourth section carried trays with red images made of *tsamba* (barley flour) and yak butter, pitchers, and brass vessels. The remaining lamas carried large circular drums, which they struck with curved sticks. Over their red garments they wore yellow cloaks, and on their heads yellow-crested woolen helmets shaped like those of the ancient Greeks.

Just below the rampart of my house a mound of dry oak brush had been erected, and thither marched the lama throng. The last person in line was the Ghiku, a sort of abbot of the monastery. He was more elaborately dressed and carried, or rather dragged, in his hand a long, quadrangular metal staff.

The brushwood pile was now lighted and the images representing devils were thrown into the fire, amid terrific noise of exploding bombs (see page 486).

The ceremony over, and the devils driven into the flames, the procession made its way back to the monastery and night fell over Muli.

Our last day in Muli was a glorious

one, during which I took photographs of the town's prayer wheels. One long row of cylindrical yak-hide wheels stood on the south side of the palace and were let into its wall. They contained miles of paper, tightly wound and covered with prayers of "Om Mani Padme Hum." All monks when passing give each wheel a turn—a most convenient way of saying millions of prayers (see page 479).

Opposite, on the public plaza, there is a small square building, open only for an hour after lunch. It contains a massive wheel, beautifully decorated, rotating on a pivot, and full of prayers. It takes much strength to turn this wheel and it is evidently meant for exercise as well as for praying (see page 478).

At 5 o'clock that afternoon I called upon the king to thank him for his kindness and hospitality. He graciously received me and seemed loath to have me go, saying he hoped I would come again. I was about to leave, when the lord high treasurer entered with a large tray loaded with gifts. Of these I prize most a golden bowl, two Buddhas, and a leopard skin.

His Majesty accompanied me this time not only to the door, but to the stairway, on which had gathered many curious slaves, who flew headlong in fear down the steps at the king's approach.

At the palace gate were assembled the church dignitaries, who escorted me to the big gate of Muli, lined up, and bowed me out.

PARTING GIFTS FROM THE KING OF MULI

We left Muli before sunrise, but took one last ride through the gates of this lama stronghold past the palace. We were met by the lama officials, among them the magistrate and judge, as well as our friend the military chief. They bowed, and we passed out through the south gate into the Muli Valley.

We were soon overtaken by the king's secretary, mounted and accompanied by a Hsifan servant. Despite his poverty, he presented me with two large brass ladles as souvenirs. Then he rode with us as far as Sili, on the other side of the Muli Valley. There he emptied a bag full of mandarins and walnuts, a parting gift from the Muli king (see illustration, page 490).

We proceeded through the wilderness. The mountains were sharply outlined against the sky. In the north was one vast sea of ranges, pink and yellow, with black slopes indicating fir forest interspersed with brown meadows.

Higher and higher we ascended through silent forests. The deep valleys were lined on both sides with snow-capped crags. Little Muli lay on the steep hillside, beautiful in the morning sun, an oak forest surrounding it like a somber garland.

A peculiar loneliness stole into my heart as I rode through the firs draped with long yellowish lichens. I thought of the kindly, primitive friends whom I had just left, living secluded from the world, buried among the mountains, untouched by and ignorant of Western life.

I climbed a ridge and lingered to take a last look at the tiny capital, where I had been received with such extraordinary courtesy and hospitality by its lama sovereign.

Passing through quiet forests of pine and oak, which gave place to spruce and rhododendron higher up, I reached my first camping ground, Agù, at 12,000 feet elevation, in the midst of a fir forest. The king had ordered eight men to go out the day before and prepare camp for us (see illustration, page 487). This kindness was repeated every night while we were in his domain. The balsam fir boughs were so arranged as to form a lovely compound, the fragrant branches covering the frozen ground.

There we pitched our tents and there I let my dreams take me back once more to Muli, that weird fairyland of the mountains, where its gold and riches of the Middle Ages contrast with butter lamps and pine-chip torches.

Photograph by Joseph F. Rock

TIBETAN, LUTZU, AND NASHI PORTERS OF THE NATIONAL GEOGRAPHIC SOCIETY'S EXPEDITION, AT THE FOOT OF THE SILA PASS, ELEVATION 12,000 FEET, READY FOR THE ASCENT TO THE SUMMIT: NORTHWEST YÜNNAN

THE NATIONAL GEOGRAPHIC SOCIETY'S YÜNNAN PROVINCE EXPEDITION

By Gilbert Grosvenor, LL. D.

President of the National Geographic Society

SINCE the publication of the first of Mr. Joseph F. Rock's articles based on the work of the National Geographic Society's Expedition in Yünnan Province, China,* it has been possible to examine in detail the collections of plants, seeds, birds, and mammals which the leader of the expedition has brought back to the United States.

A brief summary of the achievements of The Society in this field will be of interest to its members.

In February, 1923, the National Geographic Society took over from the U. S. Department of Agriculture the expedition into Yünnan Province, southwest China, headed by Mr. Rock, previously known to readers of the National Geographic Magazine as the agricultural explorer who found, among the hills of Burma, the trees which produce the chaulmoogra-oil seed, a specific for leprosy.

The Society provided Mr. Rock with funds which enabled him greatly to extend the scope of his work in Yünnan, with the result that during the succeeding eighteen months he made researches and explorations which not only have increased our knowledge of a little-known part of China, inhabited by many diverse tribes, but which will materially enrich the flora of the Western World and may, through the discovery of a blight-resistant chestnut, prove of incalculable importance in restoring to American forests one of our most valuable trees.

It was toward the collection of the blight-resistant chestnuts and specimens of other economic plants that the activities of the expedition were mainly directed. Large quantities of chestnuts of apparently immune species were forwarded by registered mail direct to the Department of Agriculture. A fine collection of seeds of coniferous trees, such as spruces, firs, hemlocks, pines, and junipers, was also sent.

* See "Banishing the Devil of Disease Among the Nashi," in the National Geographic Magazine for November, 1924.

Besides these seeds of economic importance, Mr. Rock sent to America numerous rare and promising species of primrose, larkspur, gentian, and other flowering plants.

COLLECTIONS WILL ADD BEAUTY TO GARDENS OF THE WORLD

The expedition's rhododendron collection is the most remarkable ever brought together, including 493 species, or more varieties than had been previously known in America. These, it is believed, will prove of great value to horticulturists throughout the United States, and many new species of this handsome genus of flowering shrubs may be established. They come mainly from the high mountain districts of Yünnan and exhibit wide range in habit of growth and color of flower.

Complete sets of these rhododendrons have been sent as gifts of the National Geographic Society to Kew Gardens at London, to the Royal Botanic Gardens at Edinburgh, and one each to Hon. Vicary Gibbs and Mr. A. K. Bulley, both of England, amateurs who specialize in these plants and whose collections are famous.

In the United States The Society's rhododendrons will soon blossom in Golden Gate Park, San Francisco; in gardens of the Puget Sound region, and in herbariums along the eastern seaboard. Later, when the seeds which have been sown in the Department of Agriculture's greenhouses near Washington have developed into sturdy young plants, further distribution will be made.

Dr. David Fairchild, in charge of the Government's plant importations, reports that Mr. Rock's chestnuts, which include several species heretofore unknown to the horticultural world, and perhaps new even to botanical science, may be used to replace our rapidly disappearing forests of American chestnut. These blight-resistant species are of interest to the tanning industry, which has always depended upon chestnut bark to a great extent, and

Photograph by Joseph F. Rock

THE SALWIN-IRRAWADDY DIVIDE

The chief work of the National Geographic Society's Expedition was in a region where three of the world's greatest rivers almost converge (see map, page 450), flowing parallel for a short distance, then going their several ways—the Salwin to enter the Indian Ocean, the Mekong to flow into the South China Sea, and the mighty Yangtze to mingle its waters with the distant Yellow Sea, far to the northeast.

Photograph by Joseph F. Rock

THE CAMP OF THE NATIONAL GEOGRAPHIC SOCIETY'S EXPEDITION ON THE SLOPES OF MOUNT DYINALOKO, AT AN ELEVATION OF 13,500 FEET

The plants in the meadow are mostly blue anemones and orchids.

Photograph by Joseph F. Rock

IN THE LOVELY RHODODENDRON FOREST ON A HIGH SPUR LEADING TO THE SUMMIT OF MOUNT GIBÒH, OF THE YANGTZE-YALUNG WATERSHED

The trees are mostly *Rhododendron heliolepis, Picea,* and *Quercus semecarpifolia,* besides bushy rhododendrons of various species. The ground is covered with beautiful, rich, green moss. Elevation, 12,000 feet.

which now faces the possibility of its elimination through the ravages of blight.

THE SECRETARY OF AGRICULTURE THANKS THE SOCIETY

The following letter bespeaks the appreciation of the Department of Agriculture to the National Geographic Society for the gifts which nearly a million members of The Society have made possible through their support:

DEPARTMENT OF AGRICULTURE
WASHINGTON, *July* 8, 1924.

DR. GILBERT GROSVENOR,
President, National Geographic Society, Washington, D. C.

MY DEAR DR. GROSVENOR:

I have your letter of June 27, in which you formally present to this Department, on behalf of the National Geographic Society, the seeds collected by Professor Rock in the Province of Yünnan, southwestern China.

It gives me pleasure to express the appreciation of this Department for the service the National Geographic Society has rendered American horticulture in this connection.

At the same time, I desire to compliment Professor Rock on the unusual piece of exploration he has carried out in a remote section of the world, where travel is not only arduous, but at times extremely dangerous.

Members of this Department have followed with interest his wanderings of the last eighteen months, and have particularly marveled at his success in packing and forwarding his collection of seeds to Washington. We know that it is an extremely difficult matter to prepare and dispatch shipments of perishable seeds in a region like Yünnan.

So far as we are aware, not a single packet of the seeds forwarded by Dr. Rock has been lost in transit.

Many thousands of these seeds have germinated, and young plants are growing at our Plant Introduction Garden at Bell, Maryland. In addition, the Department has distributed collections of Professor Rock's rhododendrons and alpines to a number of nurserymen and park superintendents in this country, and to the principal botanic gardens and private plant collections of Great Britain, where it is thought they should succeed.

Your generous financing of the Yünnan Expedition, which enabled Professor Rock greatly to extend the scope of the work, and the coöperative spirit of the arrangement through which it was possible for him not only to send to this Department such seeds as he might collect in the course of his travels, but even to devote much of his time to this work alone, are keenly appreciated.

I hope that many of the plants introduced as a result of this expedition may enrich our national agriculture and horticulture, and that they will stand as a monument to Professor Rock's skill and industry as an explorer, and to the National Geographic Society's public-spirited support of foreign exploration.

Sincerely yours,
(Signed) HENRY C. WALLACE,
Secretary.

NATIONAL MUSEUM IS GIVEN THREE VALUABLE COLLECTIONS

The Expedition's activities were not confined exclusively to gathering seeds, however. Mr. Rock collected some 60,000 sheets of herbarium specimens in the extreme northwest of Yünnan, in Tsarong, southeastern Tibet, in eastern Yünnan, and in the independent lama kingdom of Muli (see preceding pages 447 to 491).

More than 1,600 birds and scores of mammals were also collected, skinned and prepared, and carefully labeled, with notes on the color of eyes, locality, altitude, and date of collection. The birds came from regions where few collections had been made previously, mainly from the high mountain districts of northwest Yünnan, along the Salwin-Mekong divide, on the slopes of the Likiang snow range, and from southwestern Szechwan.

These collections were tendered as a gift from the National Geographic Society to the U. S. National Museum, in the belief that they would prove a valuable addition to our knowledge of the flora and the fauna of this remote region.

The gift has been accepted by Mr. W. de C. Ravenel, in charge of the Museum, who writes:

"It gives me much pleasure to acknowledge the receipt of a collection of approximately 60,000 sheets of plants, about 1,600 birds, and 60 mammals from Yünnan and Szechwan, China, and southeastern Tibet, secured by the National Geographic Society's Expedition under the direction of Mr. J. F. Rock.

"Dr. Leonhard Stejneger, Head Curator of Biology, states that this collection is of unusual interest and value and reflects great credit on the intelligence and industry of the collector. The Museum

Photograph by Joseph F. Rock

THE LEADER OF THE NATIONAL GEOGRAPHIC SOCIETY'S YÜNNAN PROVINCE EXPEDITION ON THE SUMMIT OF TAYIN SHAN

This peak is eight miles from Tengyueh, west Yünnan. The explorer, Mr. Rock, stands beside one of the numerous species of rhododendron, the seed of which he shipped back to the United States.

would be very fortunate if he should continue his explorations and we were given the custody of the material secured.

"Dr. C. W. Richmond, Associate Curator of Birds, states that the bird skins represent by all odds the most important single contribution which has been received by the National Museum from the localities in Asia which are represented and, possibly, from any other part of Asia.

"The specimens are well prepared, fully labeled, and reached the Museum in perfect condition. The ornithologists who unpacked them have no improvements to suggest as to the method employed in packing, preparation, or shipping. Genuine approval was expressed by all who had a hand in the unpacking of the material, especially when it was known that the birds were collected by a botanist who had not received previous training in this work.

"The material contains numerous species of birds new to our collections, and possibly two or more genera not previously represented here, but the full details will not be known for some months.

"I assure you of my sincere thanks for and appreciation of this notable addition to our collections, which is recorded as a gift from the National Geographic Society."

Other illustrated articles by Mr. Rock, describing his adventures while making these collections, will be published in subsequent issues of the NATIONAL GEOGRAPHIC MAGAZINE.